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THESIS

A RELATIONAL DATA DICTIONARY COMPATIBLE WITH THE NATIONAL BUREAU OF STANDARDS INFORMATION RESOURCE DICTIONARY SYSTEM

by

Robert A. Kirsch II

December 1985

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This thesis takes a look at two types of data management tools available today, the elational Data Base Base Management System (DBMS) and the Data Dictionary (DD). It dis-usses desirable DBMS and DD characteristics with particular attention being paid to the hortcomings of DDs. It also describes the effort of the National Bureau of Standards (NBS) o develop a DD standard and examines in detail the NBS Information Resource Dictionary ystem (IRDS) and how the standard was implemented in a prototype IRDS.

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A Relational Data Dictionary Compatible with the National Bureau of Standards Information Resource Dictionary System

by

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Submitted in partial fulfillment of the
requirements for the degree of

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NAVAL POSTGRADUATE SCHOOL
December 1985

ABSTRACT

Data is a very valuable corporate asset. How it is managed and controlled can often determine the success or failure of a corporate venture. With this fact in mind many organizations are taking a close look at what tools are available to help them in this effort.

This thesis takes a look at two types of data management tools available today, the Relational Data Base Management System (DBMS) and the Data Dictionary (DD). It discusses desirable DBMS and DD characteristics with particular attention being paid to the shortcomings of DDs. It also describes the effort of the National Bureau of Standards (NBS) to develop a DD standard and examines in detail the NBS Information Resource Dictionary System (IRDS) and how the standard was implemented in a prototype IRDS.

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I. INTRODUCTION

A. BACKGROUND

In the corporate world data is a very valuable resource. Many organizations spend a great deal of time and corporate assets trying to control it. Data is used to facilitate the management decision process by providing the manager with timely, accurate and relevant information. Since the quality of the decisions made by today's managers is so important, it is very critical that the corporate data resource be easy to access, as accurate as possible, and properly and effectively managed. [Ref. 1]

Concern over corporate information resources has resulted from the explosive growth in the size, complexity and number of data bases available to managers. This data base explosion has also ushered in the need for better tools to manage the corporate data base. A critical software tool that has been developed to control and manage data is the Data Base Management System (DBMS).

E. F. Codd has identified nine functions that the ideal DBMS should have (See Figure 1.1) [Ref. 2]. Kroenke states that

> DBMS products vary in the degree to which they provide these functions. Currently, no commercial DBMS provides all nine functions entirely satisfactorily. These functions are necessary and important, however, and this situation should change as DBMS products evolve and as new products are developed. [Ref. 3]

Of the nine functions listed in Figure 1.1, the one that is of particular interest to the Data Administrator (the individual who is responsible for the management of the data dictionary and for its effective use in the pursuit of data resource goals) is the function of providing a user-accessible catalog for data descriptions.

B. OBJECTIVES

The changes in today's end-user environment reflects the growth in computer literacy and increased need for data. Users are demanding increasingly better access to data via interactive processing, ad-hoc queries, specialized reports and simpler man-machine communication. At the same time there is growing concern over the timeliness, validity, and relevance, and usability of the data that is available.

As a result, there has been a growing interest in two tools which provide highly visible support for the information processing community-data dictionaries and relational data bases. Most relational data base products provide only rudimentary dictionary capabilities, "the offerings provide little more than a method of defining the schema." [Ref. 6] The relational data dictionary has become the link that connects the user/analyst with the DBMS. [Ref. 7]

The relational data dictionary, that is the data dictionary normally provided with a relational DBMS has additional weaknesses besides the ones mentioned above:

* They do not provide a full range of functions
* Their ability to interface with more than one DBMS is limited or non-existent
* There is a broad divergence concerning the scope of data dictionaries and until recently there has been no universally accepted standard [Ref. 8], [Ref. 9].

It is interesting to note that these problems apply to data dictionaries in general and not just to the relational variety. The purpose of this work is to create a prototype of a relational dictionary based on the

The usefulness of the catalog is greater if it contains not only data descriptions but also data about the relationship between programs and data, e.g., which programs access which data, and what they do with it. [Ref. 4]

1. Store, retrieve, and update data
2. Provide integrity services to enforce data constraints
3. Provide a user-accessible catalog of data descriptions
4. Control concurrent processing
5. Support logical transactions
6. Recover from failure
7. Provide security facilities
8. Interface with communications control programs
9. Provide utility services

Figure 1.1 DBMS Functions

The problem that arises is that some DBMSs have limitations on how well they maintain the meta-data (data that describes other data or data bases). Meta-data include descriptions of the meaning of data items, the ways in which the data are used: the sources of particular data elements: the physical characteristics and rules or restrictions on their forms or uses. When the meta-data deals strictly with where data stored in the DBMS it is referred to as a Data Directory but this capability is not enough. The Data Dictionary (DD) system is an expansion of the DBMS description cataloging capability. The Data Dictionary system is a key tool available to the Data Administrator for the management of meta-data and information resources. The DD provides facilities for recording, storing and processing descriptions of and organization's data and data processing resources. [Ref. 5] specified standards for dictionaries recently developed by the National Bureau of Standards (NBS). Chapter 2 discusses dictionary concepts in general and reviews functionality of existing dictionary capabilities with special attention on relational systems. Chapter 3 discusses the features and capabilities which form the basis of the NBS draft proposal American National Standards (dp ANS) Information Resource Dictionary System (IRDS). Chapter 4 outlines and discusses the IRDS features that were selected for inclusion in the relational dictionary prototype and how those features were actually implemented.

II. DATA DICTIONARY FUNCTIONS AND CAPABILITIES

A. GENERAL

The Data Dictionary (DD) is of great importance to the DBMS administrator and user because it allows the administrator to control how data and data bases are described and structured and it provides the link that connects the user to the DBMS. A data dictionary is a repository of data about data and processes associated with a particular system or organization.

B. DBMS DATA DICTIONARY CAPABILITIES

The data stored in a DBMS data base may be organized along hierarchical, network or relational lines. This organizational capability also exists for the data in the Data Dictionary, which in most cases is actually data stored in the DBMS itself. Data dictionaries implemented in this fashion are most often referred to as a DATA DIRECTORY (how the data is stored in the data base). On the other hand the implementation of a data dictionary can be on such a scale that it incorporates all of the data resources available to an organization. An implementation such as this is often referred to as INFORMATION RESOURCE MANAGEMENT. [Ref. 10] This thesis is most concerned with data dictionaries of the information resource management type.

The DBMS acts as a librarian for the data base, storing and retrieving data according to a particular format [Ref. 11]. However, a DBMS does not necessarily provide for the security, integrity, accountability, or maintainability of that data. These objectives are best achieved when a data dictionary is used in conjunction with the DBMS [Ref 12].

A DD is an instrument for describing an organization's meta-data. Meta-data refers to that data which describes other data or data bases and includes descriptions of the meaning of data items, the ways in which the data are used; the sources of particular data elements; the physical characteristics; and rules or restrictions on their forms or uses [Ref. 13].

There are additional capabilities that should be made available to the DBMS user as part of the data dictionary [Ref. 14]:

1. Retrieval and analysis capabilities which assist the user in application development.

2. The ability to generate pre-defined, customized and user defined reports via some type of report writer.

3. The ability to extend the data dictionary as necessary to meet the DBMS user's unique needs.

4. Data management tools that are intended to ensure the security, validity, recoverability and integrity of the data dictionary system and its associated data bases.

5. Software interfaces that allow other software modules to access the data base via the dictionary and the capabilities of translating the meta-data into file definitions usable by the software.

M. T. Vanecek described the capabilities listed above as those most important from a DBMS auditor's standpoint but it is easy to see that they could apply to many types of users. [Ref. 15: pp. 15-16]

P. P. Uhrowczik describes the capabilities listed above as being derived from the "management use mode." He goes on to identify additional DD capabilities that should be available to the DBMS user in what he calls the "computer use mode" [Ref. 16: pp. 332-334]:

1. Data Mapping. Where the user is no longer concerned with what is sometimes called the "physical-equal-logical" environment. This is accomplished by removing the awareness of where data is stored and giving it to the DD.

2. Data Conversion. During the mapping process, data can be converted to a different format. For instance, data physically stored as

character can be retrieved and converted to decimal.

3. Data compaction. Data can be stored in a compacted form (encoded), but presented to the user in a more meaningful format (decoded).

4. Input and output validation. Data entering a program (input) or data entering physical storage (update) can be checked against pre-established editing standards. For example, data can have a specified format, and lie within a specified range of values.

5. Test-data generation. System-generated test data with characteristics as described in the DD can be presented to the user.

6. Logical record and file definitions. A user is generally interested in processing only certain data elements forming a logical record and desires that these logical records be presented to him in a certain sequence. In Figure 2.1 the user defines his logical record as a series of element names and states his desire to process the file sequentially in a DEPT/MANNO sort sequence. The fact that the file comes physically from two different data sets is pre-defined in the DD/D. Thus the system can deliver the logical records properly assembled in the requested sequence. The user and the program do not need to know about the two data sets that are required to produce the view.

7. JCL Generation. Job Control Language (JCL) statements for physical data sets can be automatically generated as required by the particular operating system in use. This not only eliminates the user's pre-occupation with JCL, but also facilitates migration to different operating systems.

8. Access to distributed data bases. Data bases or portions of data bases may be physically stored in different locations on different computers, linked via data communication facilities. The data directory located with each distributed data base would describe the physical data located at that site, as well as, physical data located at other sites. The DBMS can decide based on the information provided by the DD whether to satisfy the request locally or from a remote location.

C. DATA DICTIONARY CAPABILITIES

The capabilities listed above describe the data dictionary capabilities that should be available to any DBMS user. However this view of the desired data dictionary capabilities is limited, since it perceives the data dictionary as an extension of the DBMS itself and not as a true data dictionary. It is possible, on the other hand, to view the data

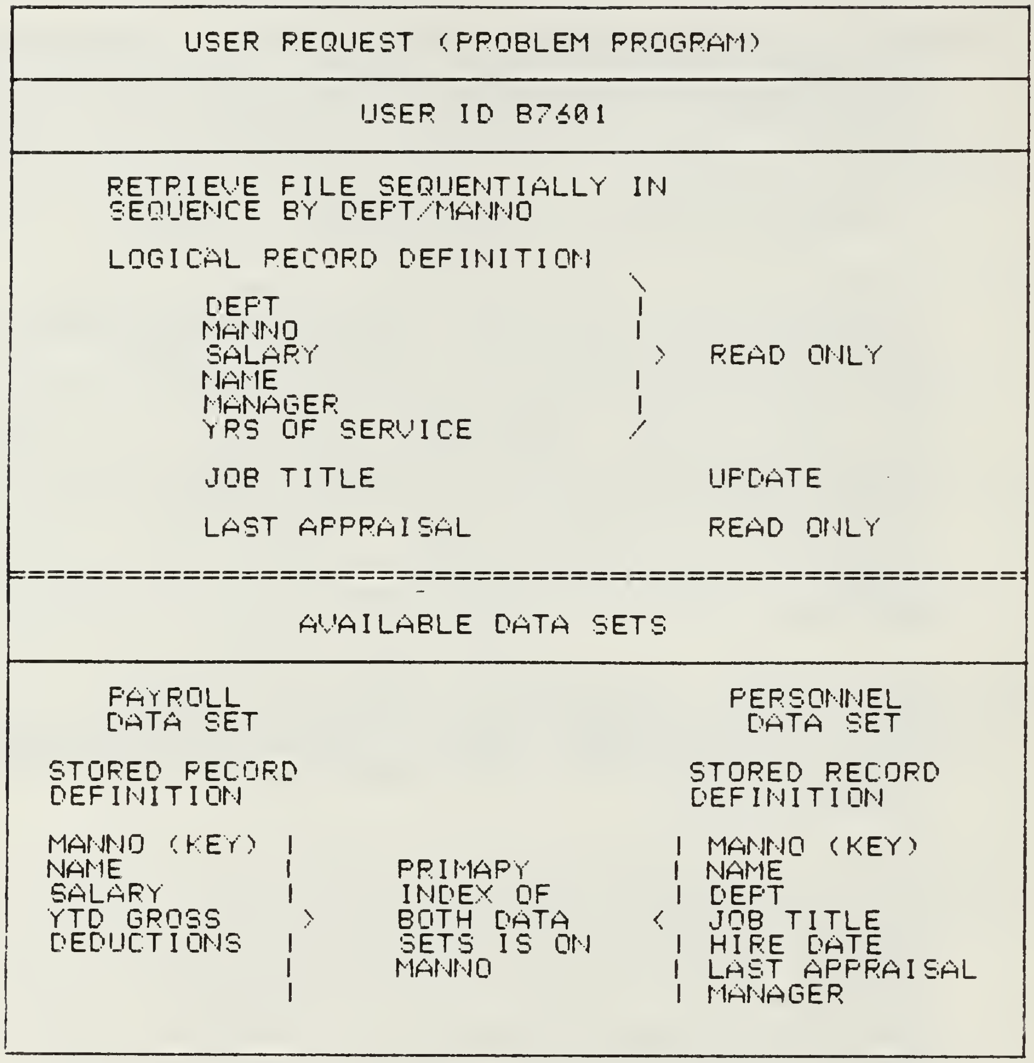

```
USER REQUEST (PROBLEM PROGRAM)

USER ID B7601

RETRIEVE FILE SEQUENTIALLY IN
SEQUENCE BY DEPT/MANNO

LOGICAL RECORD DEFINITION
                                         \
         DEPT                            |
         MANNO                           |
         SALARY                          >   READ ONLY
         NAME                            |
         MANAGER                         |
         YRS OF SERVICE                  /

         JOB TITLE                           UPDATE

         LAST APPRAISAL                      READ ONLY
==============================================================
AVAILABLE DATA SETS

   PAYROLL                                      PERSONNEL
   DATA SET                                      DATA SET

STORED RECORD                               STORED RECORD
DEFINITION                                  DEFINITION

MANNO (KEY)  |                              | MANNO (KEY)
NAME         |        PRIMARY               | NAME
SALARY       |        INDEX OF              | DEPT
YTD GROSS     >       BOTH DATA            <  JOB TITLE
DEDUCTIONS   |        SETS IS ON            | HIRE DATE
             |        MANNO                 | LAST APPRAISAL
             |                              | MANAGER
```

Figure 2.1 Logical Record and File Definitions

dictionary as an entity unto itself whether it is from standing or DBMS dependent. The capabilities and functions shown in Figure 2.2 and described below represent a joing of the capabilities and functions described by Allen et al [Ref. 17: pp. 248-253] and Lefkovits et al [Ref. 18: pp.2-7 thru 2-29].

1. Dictionary Schema

Denotes the structure of the dictionary. Both sources agree that, at a minimum, a DD should allow for the definition of Entities, Relationships and Attributes. Entities are the basic unit of the dictionary and represent real world objects or things about which certain information exists in the dictionary. Relationships provide information about associations between entities whereas attributes provide information about entities and relationships that exist in the dictionary. Figures 2.3 and 2.4 show examples of commonly used entities and relationships.

- Data Dictionary Maintenance
- Schema
  - Entity-types
  - Attribute-types
  - Relationship-types
- User Dialogue
- Dictionary Commands
- Extensibility
- Status Facilities
- Report Processor
- Query Processor
- Convert Function
- Software Interface
- Data Management
  - Security
  - Integrity
  - Concurrent Control
  - Internal access to DD

Figure 2.2 Data Dictionary Capabilities

Entity names should be unique but facilities to track duplicate names in the form of aliases or synonyms hould be provided. Additionally,

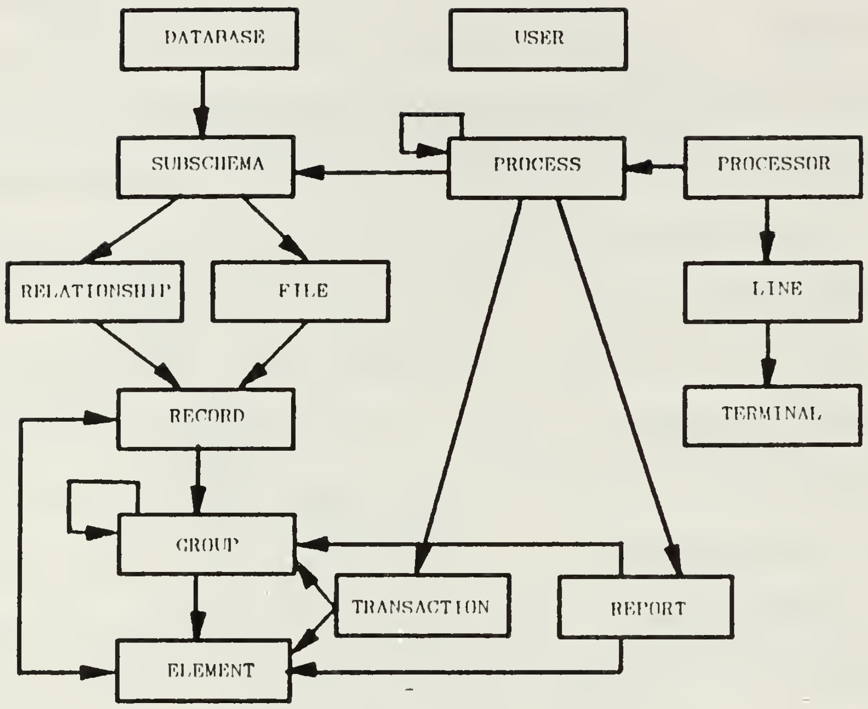


Figure 2.3 Logical Structure of a Typical DD
(from Allen et al)

```
       USER/USAGE
            |
            |
   SYSTEM/SUBSYSTEM
            |
            |
     PROGRAM/MODULE
            |
            |
          FILE
            |
            |
      GROUP/RECORD
            |
            |
  ITEM/DATA ELEMENT
```

Figure 2.4 Hierarchy of Entity-types
(from Lefkovits et al)

the DD should allow a minimum of three groupings of entity-types: Data-Element, Processes, and Usage.

The dictionary system should also provide a means of grouping together dictionary elements that have the same characteristics. This can be accomplished through the establishment of Entity-types, Relationship-types and Attribute-types. It can also be accomplished through the establishment of a Key-word In-context feature. Neither author provided specific examples of atribute or relationship types. Both did agree that most DD provide enough attribute-types and relationship-types to meet the average user needs. In addition they identified the extensibility feature which would allow a DD user to expand the DD to meet his individual requirements.

2. <u>User Dialogue</u>

The method used by the DD to communicate with the user and vice versa.

a. keyword-driven language

b. position-sensitive transactions

c. interactive, prompted input

d. interactive, performatted screens or menus

3. <u>Dictionary Commands</u>

Provide user with the ability to use the DD system to its fullest extent. Dictionary commands can be divided to the following categories.

a. Dictionary Maintenance Commands

Those commands that allow entities, relationships, and attributes to be created, modified and deleted from the dictionary.

b. Report and Query Commands

Those commands that allow the user to request the system to generate listings of entities, relationships and attributes and generate queries on such things as the usage of dictionary entities, keyword and synonym searches.

c. Data Structure Interface Commands

These commands give the DD system the ability to generate descriptions of data structures in such a way that they can be processed by other language processors, such as language compilers or DBMS schema/subschema utilities.

d. Extensibility Commands

These commands are discussed in 4 below.

e. Status-related Commands

Will be discussed in 5 below.

f. Security Commands

These commands provide the system with the ability to exclude some users from access to the system or restrict his ability to modify and change the system.

g. Dictionary Processing Control Commands

These commands allow the user to perform such functions as log-on, log-off, terminate operation upon error, etc.

h. Dictionary Administrator Commands

These commands will allow the dictionary administrator to:

* initially create the dictionary system
* recover the dictionary after a failure
* set default values

* create back-up copies of the dictionary

4. Extensibility

A feature that allows the DD structure to be extended by definition of additional entities, relationships, and attributes.

5. Status Facilities

Allows the dictionary system to be used in a System Life Cycle environment, that is the system would allow for the designation of an entity as being "Under Development," "Production" or "Archive" for example.

6. Report Processor

This capability allows the user of the DD system to produce predefined reports, the ability to customize reports and produce user-defined reports.

7. Query Processor

This capability would give the DD user the ability to generate English-like queries of the system. This query capability is analogous to the corresponding function in DBMSs for access to data bases.

8. Convert Function

This function allows the DD system to read application programs, libraries and schemata and generate DD maintenance input transactions to automatically create a DD schema.

9. Software Interface

This capability provides a formatted pathway, enabling the DD system to provide meta-data to other software systems such as compilers.

10. Data Management

This function would provide for the data base management tasks such as:

* Security

* Integrity

* Concurrent control

* Internal access of the DD

Not all data dictionary systems possess the capabilities listed above in fact, early data dictionary systems were little more than document generators, taking the meta-data that had been stored in them and printing out reports describing file and record structures. Other DD which are DBMS-dependent obtain the capabilities listed above from the DBMS they are associated with. Unfortunately even DBMS products that are currently being marketed are limited in the data dictionary capabilities they offer and very few if any offer what could be classified as information resource dictionary systems. In addition to the limited DD capabilities associated with DBMS, the additional problem of lack of standardization exists.

D. ADVANTAGES OF DATA DICTIONARIES

The main advantage of a dictionary lies not in its ability to store and catalogue information about data, but in its ability to assist in the discipline of data design [Ref. 19].

This advantage can be expanded into a number of beneficial areas:

1. Information about data/corporate asset. Accurate information about how a company functions, about its employees and clients can be stored in a DBMS and defined in a data dictionary. By storing this knowledge on a magnetic media and providing for adequate backup and recovery to the data dictionary, the corporate asset is being saved from catastrophe.

2. Public vs. Private Information. The situation where only a programmer knows all of the information (institutional knowledge) about a particular application, can cause many problems not only for those who must pick up a project in mid-stream, but even for the programmer himself if it has been several months since he last worked

on the application. By incorporating his institutional knowledge about each application into a data dictionary as each new application is developed, the information becomes public knowledge for the application developer and anyone who follows him. This will substantially reduce the effort required to modify and enhance existing applications.

3. Communication tool. The data dictionary can become a repository of corporate information, i.e., minutes of meetings, memos, notes, manuals and reference texts, which can be accessed by all areas of a company. The central area of Figure 2.5 represents the communications value of a data dictionary.

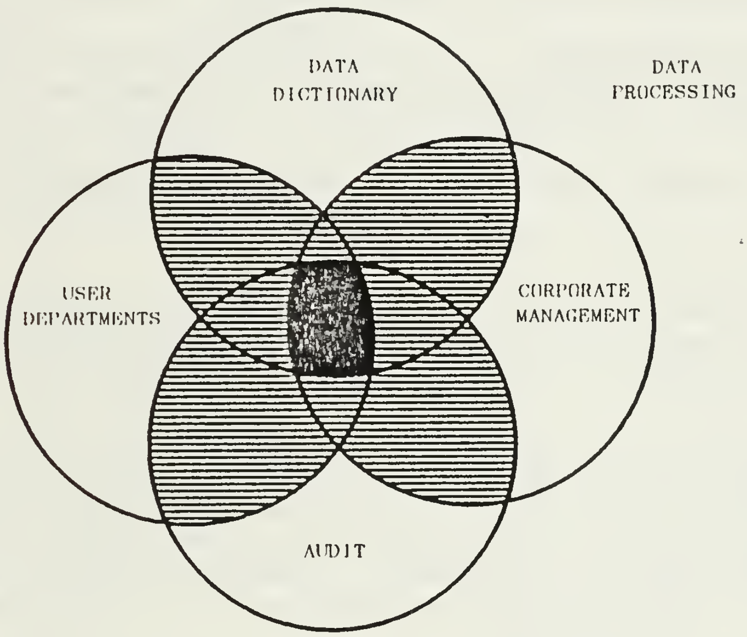


Figure 2.5 Communication Value of a Data Dictionary

4. Safeguard against Data Redundancy. Old systems are difficult to maintain because of lack of information, process redundance and data redundancy. Information availability has been discussed above. Process redundancy can be reduced through structured programming techniques. Data redundancy however requires a different approach. Data redundancy is a situation where the same data element proliferates throughout the system.

It is not uncommon in an older system to find the same data element stored in ten different locations and requiring ten different update transactions to maintain it. This same data element may be referenced by 50 different names through the system. Is it any wonder that such systems are difficult to maintain. [Ref. 20]

Listed below are various types of data redundancy:

a. Reference Redundancy - when the same data element is referenced by different names.

b. Format Redundancy - when the same data element appears in the system in different formats.

c. Group Redundancy - when data elements are grouped under a group name when no requirement exists from them in the first place.

d. Occurrence Redundancy - when repetitious data names are used to identify multiple generations of the same data element.

e. Definition Redundancy - when a data element is used for more than one purpose thus the element has more than one definition.

f. Storage Redundancy - when the same data element is stored in more than one location (redundancy of this type, sometimes serves a purpose, in distributed systems for example).

These as well as other types of redundancy not mentioned can be controlled through the use of a data dictionary.

5. Glossary of Terms. Another benefit of implementing a data dictionary is to use it as a glossary of terms. Which could be used in the development of software and as a training tool.

The data dictionary can be very effective when used as a tool to support structured analysis and design. It can be used to document data store, data flow, and process entity types. The data dictionary can also be used to generate, file segment, and record definitions for a variety of programming languages. By doing so, we can centralize the control of program data definitions. [Ref. 21]

6. Documentation. The data dictionary can serve as an effective medium for the presentation of documentation. The nature of a data dictionary makes maintenance of documentation easier and anyone who has access to a computer terminal can subsequently access the documentation.

7. System development. The "data dictionary is one more tool to increase user effectiveness in system development." [Ref. 22] the traditional approach to systems development (see Figure 2.6) can be enhanced to allow all involved in the development process, access to the necessary information as it is generated. (see Figure 2.7) This is accomplished by incorporating the DD into the traditional development network.

All of the capabilities and benefits listed above are important, but very few if any data dictionary systems available today can provide them all. In other words there is no current standard from which all data

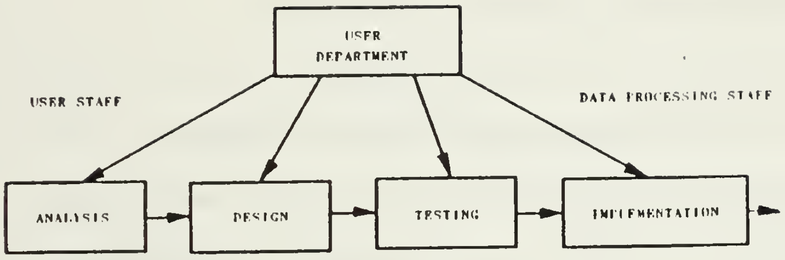


Figure 2.6 Systems Development Traditional Approach

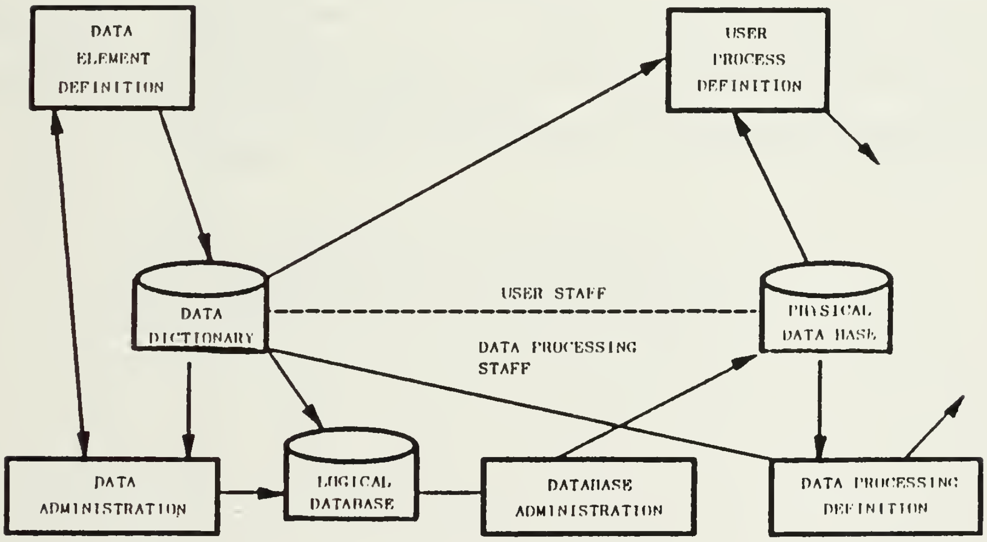


Figure 2.7 Expanded System Development Approach

dictionary products are developed. This situation is in the process of being eliminated now that the National Bureau of Standards (NBS) has formalized and published a standard for data dictionaries in the form of the Information Resource Dictionary System IRDS) standard. The feature and functions found in that standard are discussed in the next chapter.

E. EXISTING DBMS DATA DICTIONARY CAPABILITIES

As stated earlier very few DBMSs contain DDs that exhibit all the capabilities discussed above and even fewer Relational DBMSs offer the previously identified minimum DBMS dictionaries capabilities. Tables 2.1 thru 2.3 list the DD capabilities provided by the INGRES and ORACLE DBMS products. It is easy to see from the list above that the dictionary capabilities provided by ORACLE and INGRES are very limited from the standpoint of offering full data dictionary capabilities.

But what alternatives exist to improve this situation? The NBS IRDS standards offers a convenient vehicle to improve this situation. By adopting this standard as an industry-wide starting point, all products that use data dictionaries and the data dictionary itself will improve. The next chapter discusses the NBS IRDS standard in detail.

TABLE 2.1

DBMS DICTIONARY CAPABILITIES

CAPABILITY	INGRES	ORACLE
Data Dictionary Maintenance	P	P
Schema	****	****
Entity-types	L	A
Attribute-types	L	L
Relationship-types	L	A
User Dialogue	****	****
Keyword-drive	A	A
Position-sensitive Trans	N	N
Interactive	L	L
Prompted input	L	L
Preformatted screen	A	L
Menus	L	L

Facility/capability availability = A
Facility/capability available but limited = L
Facility/capability not available = N
Facility/capability as part of DBMS only = F

TABLE 2.2

DBMS DICTIONARY CAPABILITIES

CAPABILITY	INCRES	ORACLE
Dictionary Commands	****	****
Maintenance	P	P
Add	N	L
Modify	L	L
delete	N	L
Report	P	P
Query	P	P
Data Structure interface	N	N
Extensibility	N	P
Status-related	N	N
Security	P	P
Processing control	N	N

Facility/capability availability = A
Facility/capability available but limited = L
Facilitycapability not available = N
Facility/capability as part of DBMS only = P

TABLE 2.3

DBMS DICTIONARY CAPABILITIES

CAPABILITY	INGRES	ORACLE
Administration	A	A
Extensibility	N	P/L
Status Facilities	N	N
Report Processor	P	P
Query Processor	P	P
Convert Function	A	N
Software Interface	P	P
Data Management	L	P/L
Security	P	P
Integrity	N	P
Concurrent Control	N	N
Internal access to DD	N	L

Facility/capability availability = A
Facility/capability available but limited = L
Facility/capability not available = N
Facility/capability as part of DBMS only = P

III. INFORMATION RESOURCE DICTIONARY SYSTEM

This chapter discusses the features and characteristics which form the basis of the draft proposal American National Standards (dp ANS) Information Resource Dictionary System (IRDS). The chapter that follows will outline which of these features were chosen for incorporation into the Prototype IRDS.

A. BACKGROUND

As the world's largest user of information processing technology, the U. S. Government depends on this technology to carry out Government-wide programs and deliver essential public services. As with most new technologies Data Dictionary/Directory Systems (DD/DS) were being developed by numerous software suppliers each from a different set of standards. Since it is estimated that the federal government could save "$120 million in benefits by the early 1990s from use of a standard (IRDS)" [Ref. 23], the American National Standards Institute (ANSI) and the National Bureau of Standards (NBS) of the United States Department of Commerce were prompted to initiate efforts to develop standards for dictionary systems. To this end the ANSI committee for Information Systems (X3) convened a Technical Committee X3H4 to develop the standard for an IRDS in 1980. NBS at the same time established a similar committee to develop the "Federal Information Processing Standards for Data Dictionary Systems" (FIPS DDS).

Although the ANSI X3H4 and the NBS committees used different titles for standards they were developing, the two groups had identical goals and similar development approaches. The two efforts came together with the adoption of Proposal A83-020 in August 1983. The proposal called for the acceptance of the draft FIPS DDS as the Base Document for any further development of IRDS standards and has since been developed into the dp ANS IRDSs [Ref. 24], [Ref. 25], [Ref. 26], [Ref. 27].

B. IRDS DESIGN OBJECTIVES

When specifications for the standard IRDS were being developed three key objectives were always in the forefront of consideration. They were:

* The IRDS should contain the major features and capabilities found in existing Data Dictionary Systems.

* The IRDS should be modularized to promote ease of implementation and cost efficient development.

* The IRDS should support portability of skills and a wide range of user environments.

In pursuit of this goal the Institute for Computer Science and Technology of the National Bureau of Standards took the following steps:

* Preparing and disseminating the Prospectus for Data Dictionary System Standard [Ref. 28] in 1980. This document discussed the use of Data Dictionaries and plans to develop a FIPS standard.

* Conducted a Data Base Directions workshop in October, 1980 that investigated how managers can evaluate, select, and effectively use information resource management tools, in particular data dictionary systems.

* Conducted interviews with government employees that were knowledgeable in the area of data dictionaries to determine current and future requirements for data dictionary systems. The Federal Requirements for a Federal Information Processing Standard Data Dictionary System [Ref. 29] was published as a result of those interviews.

* Conducted numerous workshops for users and vendors between 1982-84 to obtain feedback on previously published documents.

* Developed a functional specification for the development of a data dictionary standard [Ref. 30].

* Prepared and disseminated in August 1983 the draft specifications for the planned Federal Information Processing Standard for Data Dictionary Systems, the document that later became the baseline standard.

1. Outgrowth of Existing Systems

All vendors who were marketing developed IRDSs or were developing IRDS were asked to review the proposed IRDS specification and make recommendations and suggestions on what should be included in or excluded from the draft standards. Many of their recommendations were subsequently included in the draft specifications.

2. Flexibility

The proposed IRDS includes a "CORE" dictionary system (which is the basis for the prototype to be discussed in Chapter 5) plus three modules. The modules are designed to interface with the core system but be independent of each other so that any or all of the modules can be implemented with the core system when desired. To provide additional flexibility, capabilities are specified in the core IRDS that allow organizations to customize or extend the IRDS as required.

3. Portability of Skill

The core IRDS contains two user interfaces: a menu driven "Panel" interface and a command language interface. The panel interface allows the system to be used by the inexperienced user. It incorporates a series of interrelated screens that guide the user through the system. The command language interface on the other hand is designed to allow the more experienced user to access the system without viewing the panels. The command language interface may be used in a batch or interface mode.

An implementation of the IRDS standard is considered complete if either of the interfaces are implemented.

C. IRDS DATA ARCHITECTURE

This section presents an overview of the framework in which IRDS data is organized and presented to the user.

1. Framework

The IRDS standard is specified in terms of entities, relationships, and attributes (see Figure 3.1).

> An IRDS entity represents or describes a real world concept, person, event, or quantity, but is not the actual data that exists in an application file or data base.[Ref. 31]
>
> A relationship is an association between two entities. An attribute represents a property about an IRDS entity of relationship as the IRDS also allows relationships to have attributes. Relationships in the Core IRDS are binary, denoting that an association exists between two entities in the IRDS.

The Core system was restricted to binary relationships because (1) the vast majority of current implementations use binary relationships and (2) it was desired that the Core system be simple enough to implement on microcomputers.

```
ENTITY  u8-20  ENTITY-TYPE = SYSTEM
     ASCAD Database_Update
   WITH ATTRIBUTES
      DESCRIPTION  (START = 100 INCREMENT = 10)
      =
       "This subsystem provides the capability for
      the staff to update the contents of the
      ASCAD Database.",
      SYSTEM-CATEGORY = "subsystem",
      SECURITY = "datamgr";
```

Figure 3.1 Sample Entity Representation

An important aspect of the IRDS standard is the concept of TYPE which is used as a way of classifying entities, relationships and sttributes. Different attributes have different meanings, for example the length of Payroll-Number or number of fields in a Payroll-Record are different. But these attributes may appear many times in relationship to other entities, length of name, length of address or number-of-fields in an Accounts-Payable record. The IRDS standard handles this situation by declaring that each attribute is a specific type called an "attribute-type." Thus there are attribute-types called length and number-of-fields.

The concept of types is extended to the IRDS relationship and entity in the form of "relationship-types" and "entity-types" see Appendix A.

Relationships within the IRDS can also have attributes, for example the relationship in Figure 3.1 between Payroll-Record and Payroll-Number could have position attribute-type with a value of 3 indicating that the Payroll-Number appears as the third element in the Payroll-Record.

The IRDS standard also allows for ordered sets of attributes called attribute-groups. This capability was incorporated into the standard because individual attribute-types don't always convey the complete message about an entity. An example of this might be the allowable-range of an entity. The allowable range has a high value and a low value which a singular attribute would not be able to convey. An attribute-group on the other hand would be able to convey this information quite easily.

2. IRDS Schema

The IRD schema describes the structure of the IRD. Thus for every entity, relationship, attribute and attribute-group that can exist in the IRD, a corresponding description of the entity-type, relationship-type, attribute-type and attribute-group-type must exist in the IRD schema. The proposed IRDS standard specifies a set of specifically allowable entries of the types listed above which are collectively called the "Core-System-Standard Schema" which will be discussed in 3. below.

The IRD schema is important for two reasons. First, the IRDS specifications allow for facilities to modify and expand the core-system-standard schema to meet the unique needs of individual users. Second, the IRD schema supports the core system plus modules approach as discussed in Section 1 of this chapter and the IRD schema allows not only extension of the schema data but also definition of additional IRDS functions.

3. The System-Standard Schema

The system-standard schema defines the allowable contents of the IRDS and is expected to be part of every IRDS implementation (the prototype IRD in Appendix E only implements a subset of the system-standard schema, this will be explained in Chapter 4). The core-system-standard schema does not contain all possible entity, relationship and attribute-types that an organization might desire. It does however represent the consensus of the organizations which participated in the original IRDS workshops and reviews. An overview of the core-system-standard schema is provided below and a complete core-system-standard schema is provided in Appendix A.

a. Entity Types

The core system-standard schema contains twelve entity-types that conceptually can be grouped into three categories, Data, Process, and External. [Ref. 32]

Data Entity-Types

* DOCUMENT, describes instances of human readable data, such as tax forms and annual reports.

* FILE, describes collections of records which represent an organization's data, such as inventory and accounts receivable files.

* RECORD, describes instances of logically associated data, such as a payroll record.

* ELEMENT, describes an instance of data, such as a social-security-number.

* BIT-STRING, describes a string of binary digits, such as 01000101.

* CHARACTER-STRING, describes a string of characters, such as "house."

* FIXED-POINT, describes exact representations of numeric values.

* FLOAT, describes exact representations of approximate numeric values.

The last four are not used to represent application entities, but are instead used by the "REPRESENTED-AS" relationship to describe the characteristics of elements:

PROCESS Entity-types

* SYSTEM, describes a collection of processes and data, such as a payroll-system or accounts-payable-system.

* PROGRAM, describes a particular process, such as print accounts-payable check

* MODULE, describes a group of programs that are logically associated, such as a sort module.

EXTERNAL Entity-types

* USER, describes an individual or organization that is using the IRDS, such as the accounting department.

b. Relational-types

The relationship-types provided for in the IRDS core system-standard schema represent virtually all connections that might be useful to users. These relationship-types are grouped into eight classes [Ref. 33]:

* CONTAINS, describes a situation were an entity-type contains other entity-types, such as Accounts payable-file CONTAINS Accounts Payable-record.

* PROCESSES, describes a situation where an entity-type acts upon another entity-type, such as Payroll-program PROCESSES Payroll-records.

* RESPONSIBLE-FOR, describes an association between entities representing organizational components and other entities, to indicate organizational responsibility. An example of such a relationship is Accounting-department RESPONSIBLE-FOR General-ledger-file.

* RUNS, describes an association between user and process entities, such as user RUNS program.

* GOES-TO, describes a situation where one process transfers control to another process. An example of this relationship is Accounts-payable-aging-program GOES-TO Aging-report-program.

* DERIVED FROM, describes a situation where an entity is derived from another entity such as Annual-report DERIVED-FROM program-file.

* CALLS, describes a situation where one entity calls another entity such as Data-entry-program CALLS Aging-program.

* REPRESENTED-AS, describes associations between ELEMENTs and certain other entitles that document the ELEMENTs format. An example of such a relationship-type is Employee-Name REPRESENTED-AS Ascil-char-string.

c. Attribute Types

The attribute-types available as part of the core-system-standard schema are the ones selected by conscientious of participating DD users and DD software developers during the development of the IRDS standard. They represent most of the attributes that an organization would need to describe the core-system-standard entity and relationship-types. The attribute-types provide [Ref. 34]:

* Audit trail information, a typical audit attribute-type is DATE-CREATED.

* General documentation for entities, for example, DESCRIPTION and COMMENTS.

See Appendix C for a complete list of the attribute-types.

4. Entity Names

The core IRDS allows flexibility in the assigning of entity names. The system also allows for several distinct names to be associated with an entity and for each name to serve a specific purpose. The core system allows for ACCESS NAME, DESCRIPTIVE NAME and ALTERNATE NAME.

The access name is the entity's primary identifier and it is the basis for the structure of most commands and panels. The access name is designed to be short, for ease of use by the system and user. Normally a user will provide the access name of an entity. However an option exists for the IRDS to generate the access names for all entities of a given type. The names that are generated by the system may be modified at a later date.

The descriptive name provides detailed information about the object represented by the entity. So the brevity of the access name poses no disadvantage to the system or user.

The IRDS does place a requirement on the user that all access and descriptive names be unique throughout the system. This requirement was generated by the ANSI X3H4 and workshop participants to insure simplicity in the command language and panel interfaces.

The core IRDS also allows for user assignment of ALTERNATE NAMES for an entity. The term alternate name is used here in the same sense as the terms "synonym" and "alias." The alternate name documents different names used to represent the same real world things. For example, the element whose access name is Social-Security-Number might have alternate names, SSN, Soc-Sec, No, and Social-Security-Number.

D. FUNCTIONS AND PROCESSES

This section describes the functions and processes provided as part of the core IRDS.

1. Populating and Maintaining the IRD

The core IRDS provides functions to add, modify, and delete entities and relationships.

a. Entities

(1) Adding Entities. This function allows the user to add/create entities to the IRD. Some important aspects of adding a new entity are:

* Declaring the type of the entity.
* Designating the assigned access name.
* Assigning a descriptive name to the entity.
* Declaring attributes and attribute-groups for the new entity.

The designated entity-type must be one that exists in the IRD schema. In order for the access name to be valid it must conform to the following rules:

* The access name must conform to the length and picture requirements of IRD schema.
* The access name used must not previously exist in the dictionary.
* If the system is to generate the access name the user must supply the entity type and starting value see Figure 3.2 for examples.

(2) Modifying Entities. This function is used to change the attributes of existing entities. When using the modify function the user may accomplish the following:

* Creation of new attributes.
* Modification of existing attributes.
* Deletion of existing attributes.

The core IRDS also offers a modification option that allows the user

```
ADD ENTITY  u8-20  ENTITY-TYPE = SYSTEM
 DESCRIPTIVE-NAME = ASCAD_Database_Update
 WITH ATTRIBUTES
    DESCRIPTION (START = 100  INCREMENT = 10)
     "This subsystem provides the capability for
    the staff to update the contents of the
    ASCAD Database."
    SYSTEM-CATEGORY = "subsystem",
    SECURITY = "datamgr";
```

Figure 3.2 Sample Command for Adding Entity

to create a new entity which has all the values of the old entityt but with some desired modification. This option allows for the easy generation of a new version of an existing entity which would be identified as a different form the original entity by a version number (Figure 3.3).

```
MODIFY ENTITY  dd_01093
WITH ATTRIBUTES
  DESCRIPTION = "A shared data field occupied by
    either cntry_code or state_code",
  SECURITY = "datamgr"
  DATA-CLASS = "alphanumeric",
  IDENTIFICATION-NAMES =
     (ALTERNATE-NAME = "cntry_st_code",
      ALTERNATE-NAME-CONTEXT = "pl1");
```

Figure 3.3 Sample Command for Modifying Entity

(3) Deletion of Entities. The core IRDS allows entities to be deleted by specifying any of the following:

* The access name.

* Entity selection criteria (access names) which will result in the creation of a new entity-list.

* The name of an existing entity-list created earlier in the session or saved from a previous session.

b. Relationships

(1) Adding Relationships. The core IRDS allows for the creation of new relationships other than those provided as part of the core. The important considerations in creating a new relationship include designating:

* The entities that are to be members of the relationship.

* The relationship type.

* Optionally, attributes and attribute groups for the new relationship.

* The entity sequence for ordered relationships.

In creating a new relationship the user need only identify the access-names of those entities associated with the relationship.

(2) Modifying Relationships. The core IRDS allows the user to modify any existing relationship by identify the relationship by type and the access associated with it. Using this function, allows the user to:

* Change a relationship's attributes.
* Create new attributes.
* Delete existing attributes.
* Change the sequence of entities associated with the relationship.

(3) Deleting Relationships. The function is provided by the core system to allow for leletion of relationships.

c. Copying Entities and Relationships.

The core IRDS allows for the creation of new entities with the same attributes, attribute groups and relationships as an existing entity. In order for the new entity to be created the user must activate the copy function and specify a new access name which is not duplicated in the system. Optionally the user may designate a new full descriptive name for the entity to be copied.

2. IRDS Output Facility

The core IRDS provides a GENERAL OUTPUT function for producing output of IRD entities, relationships, and attributes. The general output capabilities are discussed in a. below. The core IRDS also provides two additional output facilities the IMPACT-OF-CHANGE function, which provides a report of all entities that might be affected by a change to a specific entity, and the SYNTAX-OUTPUT function which generates output in the same format as data was entered to create the entity in the first place. These two functions are discussed in detail below.

a. General Output

The core IRDS requires that seven steps be completed before any output can be generated. Some of the steps are optional and therefore default values are available. The seven steps required for output generation are:

(1) Specify the views to which retrieval applies. The view is associated with the life cycle phase that the particular entity belongs to (See Figure 3.4 for an example).

```
                    Select ENTITIES "Program-2 (*:*)"

   Where *:* means all revision-numbers and all variation-numbers
```

Figure 3.4 Sample Command Line

(2) Selection of the entities to be output. This selection is performed via the entering of selection criteria. Criteria is generally entered at the initiation of the output process. Selection criteria includes (See Figure 3.4

* The type(s) of entities to be retrieved.
* Characteristics of the assigned access or descriptive name.
* Characteristics of the associated version identifier.
* Designated attributes or attribute groups.
* Life-cycle-phases.
* Relationships

(3) Sorting the entities on a series of sort parameters. The available parameters are the same as those listed in D.2 above. Suppose a user wishes to sor the selected entities based on entity-type, variation name, assigned-access-name, and revision-number. Figure 3.5 shows how the command might look.

(4) Designating what information is to be displayed include:

* The kind of entity name (access, descriptive or alternate)
* The life-cycle-phase of the entity.
* One or more of the entity's attributes or attribute groups.
* One or more relationships in which the entity participates.

See Figure 3.6 for an example.

```
entity-type (ascending), variation
  (ascending), assigned-access-name
  (ascending), revision (descending)
```

Figure 3.5 Sample Parameters

(5) Routing information which sends the output to a particular destination.

(6) Assigning a title to the output.

(7) Providing a name for the output procedure to allow it to be re- called at a later time, when the same output is required.

```
SHOW ASSIGNED-ACCESS NAME
   ASSIGNED-DESCRIPTIVE-NAME
      REVISION-NUMBER, VARIATION NAME
```

Figure 3.6 Sample Output Format Command Line

b. Output IMPACT-OF-CHANGE

AS previously stated, the IRDS allows for the printing or displaying of an Impact of Change report. This report is generated by a function that has two options. First, there is a cumulative impact-of-change option that lista all entities that will be impacted by a proposed change(s). Second, the Individual-Impact-Of-Change option produces a separate list of entities for each of the originally specified entity changes.

```
ENTITY-1
   [All ENTITY-1  information in the order in
   which it was originally entered].

   RELATIONSHIP-1  The first relationship that the
      entity participates in and all the information
      associated with the relationship.

   RELATIONSHIP-j  The jth relationship that the
      entity participates in and all the information
      associated with the relationship.

ENTITY-n
   [All ENTITY-n  information in the order in which it
   was originally entered].

   RELATIONSHIP-1  The first relationship that the
      entity participates in and all the information
      associated with the relationship.

   RELATIONSHIP-k  The kth relationship that the
      entity participates in and all the information
      associated with the relationship.
```

Figure 3.7 Sample Output Syntax Report Format

```
ENTITY-1
   [All ENTITY-1  information in the order in which
   it was originally entered].

ENTITY-n
   [All ENTITY-n  information in the order in which
   it was originally entered].

   RELATIONSHIP-1  The first relationship that the entities
      participated in and all the information associated
      with the relationship.

   RELATIONSHIP-k  The kth relationship that the
      entities participated in and all the information
      associated with the relationship.
```

Figure 3.8 Sample Output Syntax Report Format

c. Output Syntax

The output syntax function produces output that includes all information about the entity that was entered during the add-entity or add-relationship process. The output for this function has two formats. The first, involves the listing of each entity and all relationships associated with the entity (See Figure 3.7). The second, lists all for the entities first and then lists all the relationships associated with those entities (See Figure 3.8)

d. Entity-lists

The IRDS allows a user to create and manipulate lists of access names which may then be used as input to other IRDS output functions. The IRDS has functions that allow for the creation of entity lists, maintenance of entity lists, assigning of names to entity lists, output of entity lists, output of entity list names and the performance of set operations on entity lists which include union, intersection and symmetric difference.

e. Procedures

Finally the IRDS provides a PROCEDURE FACILITY that allows the user to save a sequence of operations, used to produce an output. This facility also allows for the saving of previously defined procedures under unique names, execution of previously saved procedures by specifying its name and outputting the names and structures of existing procedures.

3. <u>Schema Maintenance and Output</u>

This section expands the discussion of the IRD Schema which was introduced in Section C.2 and also discusses schema maintenance and output. In the previous sections the schema was shown to include: ENTITY-TYPES, RELATIONSHIP-TYPES, RELATIONSHIP-CLASS-TYPES, ATTRIBUTES-TYPES, and ATTRIBUTE-GROUP-TYPES all of which are described in the schema as meta-entities. Meta-entities represent real world entities in the IRD schema. Real world entities are objects of concepts such as sales manager, account, balance sheet and others. The entities that represent these objects, such as user, record or report are in turn linked by meta-relationships and both can have meta-attributes associated with them.

a. Schema Control

As stated in D.3 above the IRD schema contains meta-entities which are linked by meta-relationships with both the entities and relationships being described via meta-attributes.

(1) Meta-entity. The IRD schema allows for the following meta-entities:

* Entity-type
* Relationship-type
* Attribute-type
* Relationship-class-type
* Attribute-group-type
* Attribute-type-validation-procedure
* Attribute-type-validation-data
* Variation-names-data
* Life-cycle-phase
* Quality-indicator
* Schema-defaults

See Figure 3.9 for an example of an instance of each.

(2) Meta-relationships. Meta-relationships represent relationships between two meta-entities. The core IRDS only allows one

occurrence of a relationship between any two meta-entities. Also meta-relationships are not given individual names in the core IRDS.

Entity-type
Relationship-type
Attribute-type
Relationship-class-type
Attribute-group-type
Attribute-type-validation-procedure
Attribute-type-validation-data
Variation-names-data
Life-cycle-phase
Quality-indicator
Schema-defaults

Figure 3.9 Instances of Meta-Entities

The general form for a meta-relationship is meta-entity, meta-relationship, meta-entity. See Figure 3.10 for an example of the general form of a meta-relationship.

(3) Meta-attributes. Meta-attributes perform a descriptive role with respect to meta-entities and meta-relationships. The core IRDS allows for four general types:

* ADDED BY

* ALLOWABLE-VALUE

* DESCRIPTION

* LAST-MODIFIED-BY

* NUMBER-OF-LINES-OF CODE

Figure 3.10 Sample Meta-Attributes

* Documentation meta-attributes are used to document the purpose of the meta-entity, See Figure 3.10.

* Audit meta-attributes serve the same general purpose as the audit attribute in the IRD, that being to provide an audit trail of what has happened in the schema, see Figure 3.10.

* Schema control meta-attributes provide certain controls over what can and cannot be done to the schema.

* Dictionary control meta-attributes which provide control over the dictionary itself.

(4) A Sample Schema Structure. Figure 3.2 shows a sample schema structure involving files. It demonstrates the use of meta-entities, meta-relationships and meta-attributes in the formation of schema.

b. Schema Manipulation

The core IRDS allows for the modification of the schema via adding, modifying and deleting of meta-entities and relationships. These functions are designed to be performed by only those individuals with the proper access authorization.

(1) Adding meta-entities. The core IRDS will allow those users with the proper authorization to add new meta-entities. The kinds of meta-entities that can be added are listed in D.3.a.(1) above. New meta-entities may not be assigned the name of a meta-entity that already exists.

(2) Modifying meta-entities. The core IRDS allows the user to modify meta-entities by associating a new meta-attributes with the meta-entity, by changing an existing meta-attribute or by deleting a meta-attribute that already is associated with the meta-entity. In the case of a changed or deleted meta-attribute the IRDS will insure that the change did not adversely effect the dictionary.

(3) Deleting meta-entities. The core IRDS provides the user with the ability to delete an existing meta-entity from the schema.

However the IRDS will insure that the integrity of the dictionary is not violated.

(4) Adding Meta-relationships. The core IRDS gives the IRDS user the ability to add new meta-relationships as he sees necessary. As stated earlier meta-relationships are associations between meta-entities. The process of adding a meta-relationship requires that the user specify the meta-entities that are to be members of the relationship and any meta-attributes that will be associated with the meta-relationship.

(5) Modifying, Deleting and Replacing Meta-relationships. The core IRDS provides the user with the ability to modify, delete and replace meta-relationships. The modifying and deleting of meta-relationships is performed in the same manner as the modification and deletion of entities as explained in D.3.b.(2) and D.3.b.(3) above. The replacement of meta-relationships actually involves the combination of the delete meta-relationship and add meta-relationship functions. The replacement function is organized in this manner to insure the integrity of the IRD.

(6) Modification of Meta-entity Names. The core IRDS allows the user to modify the meta-entity name. This process however falls along the same lines as the meta-relationship replacement function. It is the forced combination of the meta-entity deletion and add functions. This process is again used to insure integrity of the IRD. One additional requirement exists and that is that the meta-entity name not be duplicated anywhere in the IRD.

c. Schema Output

The core IRDS allows those authorized to work with the schema the ability to output information about it. In order to produce the output the user must select the meta-entities to be displayed. This selection is accomplished by choosing one of the following:

* That all meta-entities be displayed.
* That all meta-entities of a specific type(s) be displayed.
* The name of a specific meta-entity.

The resulting set of meta-entities may then be sorted on one of the following parameters:

* meta-entity-type
* meta-entity-name
* Non repeating meta-attribute-types

Before the sorted list is displayed the user must specify the information about each meta-entity he wishes to see. The display options available to him are one of the following:

* meta-name
* meta-type
* One or more of the associated meta-attributes
* All or none of the associated meta-relationships in which the meta-entity participates

4. <u>The IRD to IRD Interface</u>

The IRD to IRD interface is an important feature of the core standard IRDS because it is the only controlled means for moving data between two IRDS. This facility allows an organization with more than one IRD to transfer information between them. The facility is also designed to allow IRDSs developed by different vendors to interface and exchange information, provided a communication link exists and they have followed IRDS standards. The core standard IRDS only allows for the transfer and does not have any means of providing the physical connection between the IRDS. In allowing for the interface the only important issue stressed is that the exporting and importing dictionaries and the exporting and importing schema's must be compatible.

5. IRDS Control Facilities

The core IRDS contains five control facilities that are important in populating and maintaining the IRD. These are:

* The Versioning Facility
* The Life-Cycle-Phase Facility
* Quality-Indicators
* Views
* Security

An overview of these was provided in Section D. This section presents additional detail on the structure and use of these facilities.

a. The Versioning Facility

The versioning facility provides the user with the ability to distinguish between entities that would otherwise be considered the same. The distinction is generated via the version-identifier which is composed of two parts: (1) a required revision-number and (2) an optional variation-name.

In the command language syntax the user encloses the version-identifier in parentheses and appends it to the access or descriptive entity name. Within the parentheses the variation-name (if used) is followed by the revision-number, separated by a colon. If the user does not specify a revision-number the system will default with a value of

1 to indicate that no revision exists and a value of 1 greater than the current value for any subsequent revisions.

For example, suppose a certain payroll module exists that calculates state taxes for Alabama, Georgia, and Florida and another payroll module of the same functionality calculates state taxes for California and Texas. We can describe both with the same access name PAYROLL-MODULE, and differentiate between the two with different variation-names. Thus we could have PAYROLL-MODULE (AL-GA-FL:1) which would represent the Alabama, Georgia, and Florida capable payroll module with no revision. The California and Texas module which has had three revisions would be represented as PAYROLL-MODULE (CA-TX:4).

b. The Life-Cycle-Phase Facility

The life-cycle-phase facility of the core IRDS: (1) allows the user to define the life cycle phase to meet the methodology currently being used; (2) Provides facilities to assign each entity to a particular phase; (3) Provides integrity rules concerning the passing of an entity from one phase to another. Each phase is represented in the schema as a meta-entity.

Every life-cycle-phase belongs to a "phase class" and the core IRDS recognizes three such classes:

* UNCONTROLLED -- Uncontrolled phases are "specification," "design" or "non-operational." There are no integrity rules for this class and a user may identify as many phases with this class as desired.

* CONTROLLED -- Controlled phases are those that are considered to be "operational." The core IRDS allows only one such phase the "CONTROLLED-PHASE" with its associated integrity rules. The integrity rules will be covered in the next section.

* ARCHIVED -- The core IRDS can only have one ARCHIVED life-cycle-phase, called the "ARCHIVED-PHASE" and it is used to document and

classify entities no longer in use. This class also has special integrity rules associated with it, those will also be discussed in the next section.

(1) Integrity Rules. As mentioned previously, integrity rules for the CONTROLLED and ARCHIVED life-cycle-phases are enforced by the core IRDS. These rules are based on a dierarchy of system-standard entity-types as defined by the following list. The highest in the hierarchy is the first and the lowest is the last:

* SYSTEM
* PROGRAM
* MODULE
* FILE
* DOCUMENT
* RECORD
* ELEMENT

This means that the entities are "Phase-related." The hierarchy only applies to the core standard IRDS entity types and not to any entities added by the user via the extendability facility.

These are integrity rules in the sense of controlled and archived but not in the sense of allowable ranges of attribute data values, e.g.: "sex must be 'M' or 'F'. This type of integrity is handled through the ATTRIBUTE-TYPE-VALIDATION-PROCEDURE-META-ENTITIES:

* RANGE-VALIDATION, which is used to restrict an attribute-type to an allowable set of ranges.
* VALUE-VALIDATION, which is used to restrict an attribute-type to an allowable set of values.

There are two relationship-class-types that are designated as phase-related, they are CONTAINS and PROCESSES they are combined with the entity-type to form phase-related relationship-types. Listed below in Table 3.1 are the relationship-types generated by this combination:

The general integrity rule for entities in the controlled life-cycle-phase is:

> An entity can be in the CONTROLLED life-cycle-phase only if all entities whose types are below its type on the above hierarchy and that are connected to it with phase-related relationships are also in the CONTROLLED life-cycle-phase.

The ARCHIVED life-cycle-phase has an integrity rule similar to that above:

> An entity can be in the ARCHIVED life-cycle-phase only if all entities whose types are below its type in the above hierarchy and that are connected to it with phase-related relationships are in either the CONTROLLED or ARCHIVED life-cycle-phase.

The integrity rules are designed to insure that when an entity, for example "PAYROLL-SYSTEM" is moved to a new phase, for example "OPERATIONAL-PHASE" that all of the programs and modules associated with the system are either already in the operational-phase or ready to be moved to it, thus insuring the integrity of the system.

c. Quality-Indicators

The core IRDS allows the user to define quality-indicators and assign them to entities. These quality-indicators denote such things as:

* The level of standardization of an entity (e.g., program standards, organization standards, company standards, and international standards).

* The degree to which an entity meets the user quality assurance standards, etc.

All quality-indicators must be added to the IRD schema as a meta-entity. Also the core system-standard schema does not include any indicators, so all indicators must be user defined.

TABLE 3.1

PHRASE-RELATED RELATIONSHIPS-TYPES

SYSTEM-CONTAINS-SYSTEM
SYSTEM-CONTAINS-PROBLEM
SYSTEM-CONTAINS-MODULE
PROGRAM-CONTAINS-PROGRAM
PROGRAM-CONTAINS-MODULE
MODULE-CONTAINS-MODULE
FILE-CONTAINS-DOCUMENT
FILE-CONTAINS-RECORD
FILE-CONTAINS-ELEMENT
DOCUMENT-CONTAINS-DOCUMENT
DOCUMENT-CONTAINS-RECORD
DOCUMENT-CONTINS-RECORD
RECORD-CONTAINS-RECORD
RECORD-CONTAINS-ELEMENT
ELEMENT-CONTAINS-ELEMENT

SYSTEM-PROCESSES-FILE
SYSTEM-PROCESSES-DOCUMENT
SYSTEM-PROCESSES-RECORD
SYSTEM-PROCESSES-ELEMENT
PROGRAM-PROCESSES-FILE
PROGRAM-PROCESSES-DOCUMENT
PROGRAM-PROCESSES-RECORD
PROGRAM-PROCESSES-ELEMENT
MODULE-PROCESSES-FILE
MODULE-PROCESSES-DOCUMENT
MODULE-PROCESSES-RECORD
MODULE-PROCESSES-ELEMENT

d. Views

Views are how the user logically perceives the dictionary and as such it is generally a subset of the complete dictionary. A view may be: (1) a set of entities with associate entities, attributes, and attribute-groups; (2) a set of relationships with its associated entities, attributes, and attribute-groups or (3) a set of specifications of operations that may be performed by the user.

Structurally, VIEW is an entity-type in the core IRDS system-standard schema and each view in the IRD is an instance of that entity-type. For example, if a particular programmer is working on the Payroll-system of an organization. His view of the IRD would be all the programs, modules, files, records and elements contained in or processed by the Payroll system.

The core IRDS allows an organization to define what views are available to a user thus limiting his access to the dictionary. if more than one view is available to a user, one will be designated as the default-view and will be presented to the user each time he uses the system unless he specifically specifies otherwise. Views associated with each user are stored in the IRD as attributes of the DICTIONARY-USER entity.

e. Core Security

The general mechanism that implements core IRDS security consists of the following:

* For each authorized user of the IRDS, one DICTIONARY-USER entity exists. Associated with this entity are attributes that define the user's level of access.

* Associated with each VIEW entity are attributes that define the permissions and restrictions that apply to all IRDS users allowed

to use the view. These include the abilities (independently specified for each entity-type), to read, add to, modify, and delete the entities that comprise the view.

* Finally, each DICTIONARY-USER entity is linked to those views that the user can access.

(1) Access Permission. Most IRD ACCESS PERMISSION is associated with view entities, and, for each view, the permission applies to all entities in that view. Each permission consists of several parts:

* The name of the entity-type for which the permissions are specified.

* An indicator showing if permission exists to read entities of the specified type.

* An indicator showing if permission exists to add entities of the specified type.

* An indicator showing if permission exists to modify entities of the specified type.

* An indicator showing if permission exists to delete entities of the specified type.

* An indicator showing which relationships are explicitly excluded from that view.

* An indicator showing if permission exists to modify the life-cycle-phase of entities of the specified type.

These permissions are stored in the IRD as a DICTIONARY-PERMISSION attribute-group. Each view may have multiple permissions associated with it.

The core IRDS specified five categories of permission:

* GLOBAL PERMISSION: All schema functions are allowed.

* GLOBAL PERMISSION FOR UNLOCKED META-ENTITIES: Permission to perform all schema functions except those that modify or delete meta-entities that have installation-lock set on.

* ATTRIBUTE-TYPE-VALIDATION-DATA WRITE PERMISSION: Read attribute type

validation data and modify their meta-attribute.

* ATTRIBUTE-TYPE-VALIDATION-DATA READ PERMISSION: permission to read attribute-type-validation-data and their meta-attribute.

* REPORTING PERMISSION: permission to read the complete schema.

This facility is implemented through attributes of the DICTIONARY-USER entity.

6. User Interfaces

This section discusses the command language and panel interfaces. An implementation of the IRDS may contain either or both of the interfaces but each interface will support the full capabilities of the IRDS.

As stated earlier the IRDS interfaces are designed to allow the system to communicate with the user and vice versa. The panel interface is designed to prompt the novice through the system while the command language interface is designed for the more experienced user and thus skips most of the panels used in the panel interface.

a. Command Language

The COMMAND LANGUAGE interface supports both batch and interactive modes. The commands used by the command language interface correspond closely with the functions discussed throughout this chapter. The syntax of each of the command language commands is presented in the Bacus-Naur form. Since the command language closely parallels the discussion presented in the previous sections a detailed discussion of each command will not be attempted. A summary listing of the commands and their associated functions is provided in Appendix E. However the command language is discussed and illustrated in depth in [Ref. 35].

b. Panel Interface

The core IRDS provides the user of the system a structured set of logical screens (or panels) which, when used in the proper sequence perform the functions of the system. The panels can be considered to be user friendly in that they guide the user through the procedures for a function.

The core IRDS does not specifically identify a panel structure of physical implementation of the panel interface. It is therefore up to the user to define his own panel structure and panel map (which panel follow which) for each function.

The core IRDS does provide rules for the structure of the panels used by the IRD. They are:

* Each panel shall have a unique name.
* The panel interface is to have an inter-panel structure that defines a default progression of panels.
* The first panel encountered is the HOME panel.
* The user may return to the HOME panel at anytime.

The structure of the panel interface is defined in terms of panel trees and panel areas. A panel tree is the collection of one or more panels used to perform a single function. A panel area is a portion of a panel that is associated with a particular category of information, and deals with the user interaction with the IRDS. The core IRDS identifies six different areas associated with the panel. not all of which are shown to the user at one time:

* STATE AREA -- This area will always be displayed to the user. It informs the user of the name of the dictionary being accessed, and what is being done with the current panel, for example, adding a record.

* DATA AREA -- The data area supports the user in one of two ways: It displays labels that guide the user while he/she performs data entry; and, if the user is retrieving information, it displays the results.

* SCHEMA AREA -- The schema area is primarily used during dictionary update operations. Examples of the use area include:

  - The listing of all valid entity-types, when adding an entity.

  - Displaying names of attribute-types that may be associated with an entity-type being entered.

* ACTION AREA -- The action area displays the options that a user has when proceeding from the current panel to another.

* MESSAGE AREA -- This panel area displays any errors and warning messages.

* HELP AREA -- The help area displays information that the system can provide in response to a request for help.

c. Operation on the Panel Interface

The panel interface will generally be available to all IRDS users. The core IRDS does not however, require that the panel made available to a user be tailored to meet his view of the system. The panel interface will still only allow the user to perform those functions and operations allowed according to his view and current security.

7. IRDS Modules

The draft proposed IRDS standard contains specifications for three modules which may be implemented along with the core IRDS. They are:

* ENTITY LEVEL SECURITY. [Ref. 36]

* APPLICATION PROGRAM (CALL) INTERFACE. [Ref. 37]

* SUPPORT OF STANDARD DATA MODULES. [Ref. 38]

Since the scope of this thesis deals primarily with the capabilities of the core IRDS, the references listed above should be consulted if any additional information beyond that provided is required.

a. Entity Level Security

This module allows the user the ability to assign read and write limitations to individual entities. This facility operates in addition to the security function provided inthe core IRDS.

To accomplish entity level security, the module introduces the entity-type ACCESS-CONTROLLER, and a set of SECURED-BY relationship-types that allow an ACCESS-CONTROLLER entity to be connected with entities of all other types.

b. Application Program (call) Interface

This module provides an interface from a standard programming language to the IRDS. This is accomplished by using the call feature of the programming language. In this way the IRDS is treated as an application program subroutine.

c. Support of Standard Data Models

An implementation of the specifications of this module would assist an organization in describing network and relational databases, particularly those supported by NDL and SQL command languages. The describing of network and relational databases is accomplished through the addition of three new entity-types, twelve new relationship-types, and fourteen new attribute-types to the Core System-Standard Schema, See Appendix D.

E. CONCLUSION

The NBS IRDS standards provide the Information Resource Management arena a valuable tool. An implementation of an IRDS using the core standards as discussed above would deliver to the DBMS user tremendous capability, flexibility and uniformity in describing and controlling an organizations data. Finally the capabilities described above far exceed that which is currently available with most of the dictionaries provided with DBMS products.

But is an IRDS implementation possible. The next chapter discusses just such an implementation.

IV. NBS IRDS PROTOTYPE

This chapter discusses the implementation of selected portions of the NBS IRDS standards in the form of a relational prototype IRDS provided as Appendix E. Before discussing the NBS IRDS capabilities included in the prototype. It is necessary to discuss prototyping, its advantage/disadvantages and why prototyping was chosen as the method for implementing an IRDS.

A. PROTOTYPING [Ref. 39]

Webster's dictionary defines a prototype as one of three possible things:

* An original or model after which anything is formed
* The first thing of its kind
* A pattern, an exemplar, an archetype

The second definition is probably the most relevant to this discussion because prototypes are being used in data processing as a first attempt at design which is then extended or enhanced. In general systems development, a prototype is known as

> . . . a partially complete functional model of a target system whose purpose is to provide a better understanding of the target system's requirements [Ref. 40].

A software prototype is characterized by the following feature. It is a working system, although of limited capability, rather than just an idea on paper. A prototype may become, after iterative enhancement, a production system. Its original purpose is to test assumptions about requirements and/or system design architecture. A prototype is created quickly. This has become possible only in recent years with more powerful languages such as dBase II and III which are less procedurally oriented. Some would argue however, that prototyping was the way software was developed before the advent of functional decomposition and the system development life cycle whch is generally accepted and used today.

> In the early days of software development writing programs was the thing to do. After an explanation of the problem, a period of questions and answers, and research into the nuts and bolts of a method, the programmer began his or her work. Starting with that portion of the problem that was well understood, lines of FORTRAN, COBOL or ALGOL would begin to appear. As time passed additional portions were coded until the entire program was complete. Design was conducted implicitly, if at all! [Ref. 41]

A prototype should be inexpensive to build, at least less than it would cost if a conventional high level language were used. Indeed, prototyping in data processing originated only recently because until recently, programming a protype was just as costly as programming the working system [Ref. 42]. The important point is to get something running soon to establish effective communications with the user without the use of extravagent resources. the follow-on development of a prototype is an iterative process in which improvements are made in small increments as the user developer work together and discover new requirements. [Ref. 43]

Mitchell Spiegel, formerly of Wang Laboratories, explains the prototyping approach as:

> . . . a process of modeling user requirements in one or more levels of detail, including working models. Project resources are allocated to produce scaled down versions of the software described by requirements. The prototype version makes the software visible for review by users, designers and management. This process continues as desired, with running versions ready for release after several iterations. [Ref. 44]

Traditional management information system development follows a series of steps (see Figure 4.1). Prototyping is considered as an adjunct activity to the specification of requirements (See Figure 4.2). The results of prototyping are input to the steps following requirements

Feasibility Study
Requirements
Product/Preliminary Design
Detailed Design
Coding
Integration
Implementation
Operations and Maintenance

Figure 4.1 Steps in Traditional System Development

analysis, but may or may not be used actively in those steps.

1. Advantages of Prototyping

There are several advantages associated with the use of prototyping. First a prototype usually gets the product into use as early as possible. Early use can provide assistance to the decision makers and feedback to the builders. Second, prototyping is considerably cheaper than a "full-build" approach, which delays installation until the product is complete. Third, prototyping is a convenient way of keeping the product simple, which is valuable to both builders and users. Fourth, prototyping lowers risk and expectations. [Ref. 45] Fifth, it is easy to write statements in a requirements document which say "the system shall do x" and "the system shall be capable of y." However, both the developer and the user get a more realistic feeling for the effort and cost of a feature when they must actually add it to a working model. Thus, the eventual model better represents what is feasible than a document with a series of "shall statements." Even though the functionality of a prototype product is minimal, the user is forced to think more carefully about the task being automated. This should produce a more accurate understanding of the problem [Ref. 29]. Finally, prototyping unlike traditional methods builds an effective brigade across the communication gap between the user and the developer.

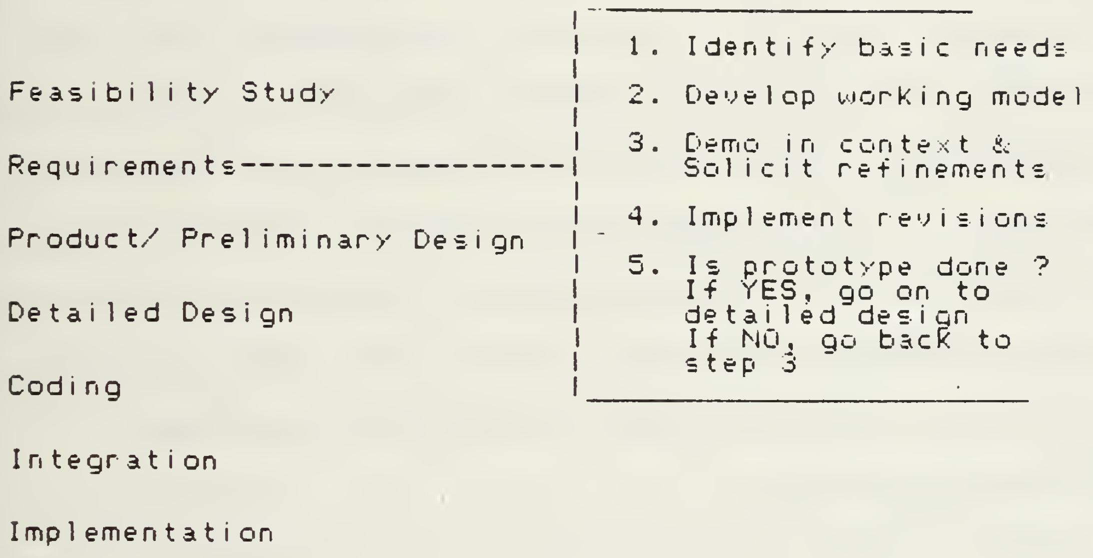

Feasibility Study
Requirements
Product/ Preliminary Design
Detailed Design
Coding
Integration
Implementation
1. Identify basic needs
2. Develop working model
3. Demo in context & Solicit refinements
4. Implement revisions
5. Is prototype done ? If YES, go on to detailed design If NO, go back to step 3

Figure 4.2 System Development Using Prototyping

2. Disadvantages of Prototyping

Prototyping has some decided disadvantages as well. Prototyping makes it difficult to plan resource use because a clear picture of what the finished product will look like is not provided. It also makes it difficult to decide whether to enhance an old version or build a new one. Analysts and user can become bored after the nth iteration of the prototype.

In using the traditional development process there are specific requirements which, when met by proof of validation, clearly mark the job as complete. Because the prototype is changing continually, it creates a problem keeping users abreast of the current version and what has been validated and what has not. Prototyping can cause a reduction in discipline for proper documentation and testing (although this has nothing to do with the prototype itself). Because there is less emphasis on hard thinking and "desk checking" there is a greater chance of missing a basic problem which could negate assumptions essential to the product being developed. Also there is the chance users may become so happy with the prototype that they consider it a functional product and want the data processing people to start work on something else. A study using the ACT/1 software package for prototyping showed increased needs for computing resources. If the productivity gained from using prototyping doesn't offset the cost of the increased computing power, then the prototyping approach is serving at a disadvantage.

3. Types of Prototyping

There are two approaches to prototyping: the throwaway prototype The throwaway prototype development process has the advantage that when the developer can show the user an immediate capability when he is through, he can just discard the product. This lowers the developer's risk and the user's expectations. The evolving prototype process on the other hand is better suited for the development of an initial capability that will evolve into a finished product. The evolving prototype has the disadvantage that the user may accept the first version and thus short circuit full development.

4. Reasons for Prototyping

Prototyping was chosen as opposed to full life cycle development, because time constraints prevented full development of a DD system whereas prototyping allowed a viewable product to be produced in the given timeframe. Additionally the evolving prototype process was used to develop the IRDS with the anticipation that additional capabilities as specified in the NBS IRDS standards would be added according to user needs as additional versions were implemented.

B. THE IRDS PROTOTYPE

dBASE III a Data Base Management System (DBMS) was selected as the development tool for the IRDS prototype, because data dictionary systems are essentially a specialized kind of database system. The prototype could have been written in Pascal or COBOL but the time required to produce a usable product would have been prohibitive. Additionally since the prototype was developed using a DBMS system certain capabilities were already available, i.e., a query processor, file maintenance routines, and high level language. The intention was not to develop a marketable pro-product but to demonstrate and evaluage the capabilities described in the NBS IRDS standard.

The IRDS prototype is based on a reasonable subset of the core features presented in Chapter 3. The features listed below constitue IRDS Prototype Version 1.0 (See Appendix C):

* Panel Interface
* Security
* Add Entity
* Modify Entity

* Delete Entity
* Add Relationship
* Modify Relationship
* Delete Relationship
* Add Schema
* Modify Schema
* Delete Schema
* IRDS Output
* IRDS Query

The remainder of the features listed in Chapter 4, though desirable, will be left for implementation in later versions.

1. A Relational Model of the IRDS

The IRDS prototype accounts for several different relations including users, systems, programs, modules, document, files, records and elements. The generalized format of these relations is as follows:

* USER (access-name, id-name, duration-type, description, date-added, added-by, comments, last-modification-date, last-modified-by, number-of-modifications)

* SYSTEM (access-name, id-name, duration-type, description, date-added, added-by, system-category, comments, last-modification-date, last-modified-by, number-of-modifications)

* PROGRAM (access-name, id-name, duration-type, description, date-added, added-by, lines-of-code, comments, last-modification-date, last-modified-by, number-of-modifications)

* MODULE (access-name, id-name, duration-type, description, date-added, added-by, lines-of-code, comments, last-modification-date, last-modified-by, number-of-modifications)

* DOCUMENT (access-name, id-name, duration-type, description, date-added, added-by, comments, last-modification-date, last-modified-by, number-of-modifications)

* FILE (access-name, id-name, duration-type, description, date added, added-by, number-of-records, comments, last-modification-date, last-modified-by, number-of-modifications)

* RECORD (access-name, id-name, duration-type, description, date-added, added-by, number-of-elements, size, comments, last-modification-date, last-modified-by, number-of-modifications)

* ELEMENT (access-name, id-name, duration-type, descritpion, date-added, added-by, element-type, element-length, low-of-range, high-of-range, allowable-value, comments, last-modification-date, last-modified-by, number-of-modifications)

for a detailed explanation of the attributes for these relations see [Ref. 47].

Relationships among the various relations are tracked by having relations with a verb name reflecting how one entity relates to another. For example, since a program can contain several modules, a program-contains-module relations is included in the dictionary. Its format is as follows:

* PROGRAM-CONTAINS-MODULE (program-name, module-name). An example of this relation would be:

```
PROGRAM-CONTAINS-MODULE  (u-8,  u-8-10)
                         (u-8,  u-8-20)
                         (u-8,  u-8-30)
```

The prototype implements twelve of the sixty-four relationships specified in the NBS IRDS standard. See Appendix A for a complete listing of the allowable relationships. Listed below are the twelve relationships included in the prototype:

* PROGRAM-PROCESSES-RECORD (program-name, record-name)

* PROGRAM-PROCESS-FILE (program-name, file-name)

* SYSTEM-CONTAINS-FILE (system-name, file-name)

* USER-CONTAINS-SYSTEM (user-name, system-name)

* USER-RESPONSIBLE-FOR-SYSTEM (record-name, system-name)

* FILE-CONTAINS-RECORD (file-name, records-name)

* RECORD-CONTAINS-ELEMENT (record-name, element-name)

* USER-RESPONSIBLE-FOR-FILE (user-name, file-name)

* PROGRAM-PRODUCES-DOCUMENT (program-name, document-name)

* PROGRAM-CONTAINS-MODULE (program-name, module-name)

* SYSTEM-CONTAINS-PROGRAM (system-name, program-name)

* PROGRAM-PROCESSES-ELEMENT (program-name, element-name)

2. Interface

The NBS IRDS standard provides for two user interface capabilities: The Command Language Interface and the Panel Interface. The Panel Interface method was chosen because it provides a "user friendly" communication link between the IRDS and the user. Figures 4.3 thru 4.6 provide a series of panel trees that diagrammatically represent panel interface system used.

The panel structure itself followed the guidelines provided in the IRDS standard (See Figure 4.7). The IRDS standard allows for six possible areas to be defined in the panel state area, data area, schema area, action area, message area and help area. All areas except the help area are included in this prototype. Figure 4.7 shows what portions of the screen are used for each of the areas.

C. IRDS START-UP

This IRDS prototype was written in dBASE III and uses panel interfacing as the means of communication with the user. The first panel that

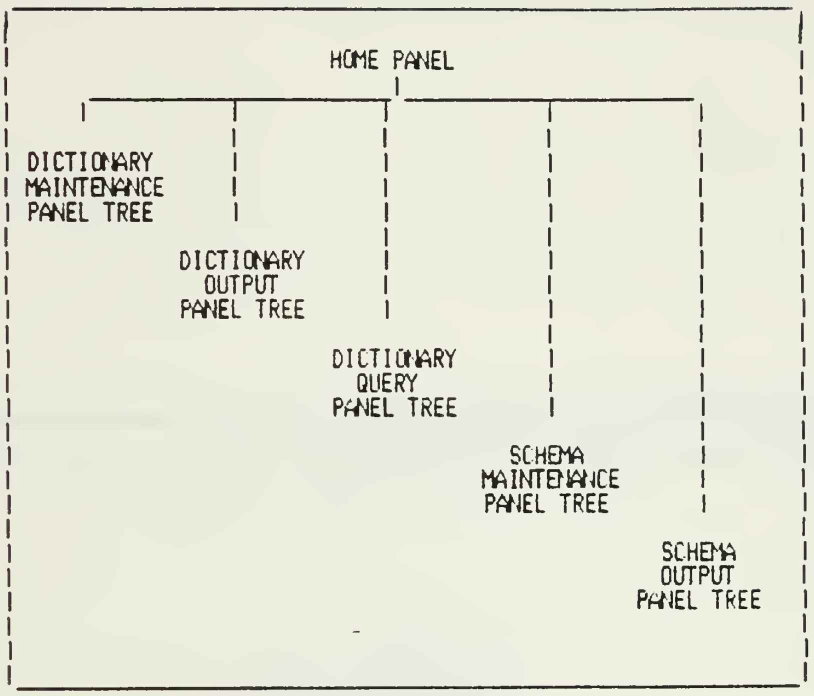

HOME PANEL
DICTIONARY MAINTENANCE PANEL TREE
DICTIONARY OUTPUT PANEL TREE
DICTIONARY QUERY PANEL TREE
SCHEMA MAINTENANCE PANEL TREE
SCHEMA OUTPUT PANEL TREE

Figure 4.3 The Panel Interface -- Overall Structure

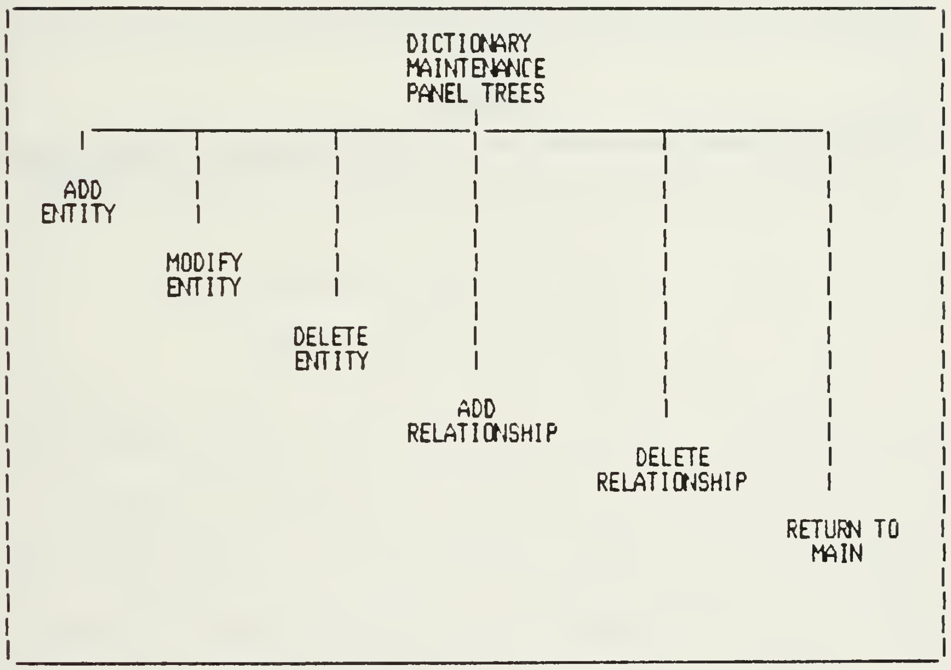


Figure 4.4 Dictionary Maintenance Panel Tree

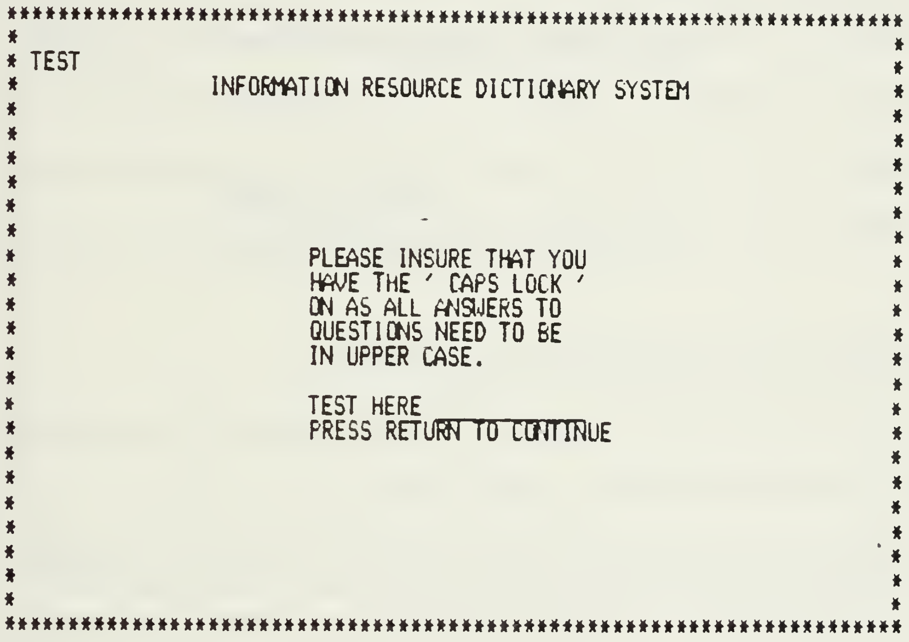
```
********************************************************************************
*                              STATE AREA                                      *
********************************************************************************
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*                               DATA AREA                                      *
*                                                                              *
*                              SCHEMA AREA                                     *
*                                                                              *
*                              MESSAGE AREA                                    *
*                                                                              *
*                                                                              *
*                                                                              *
*                                                                              *
*<-----------------------------80 CHARACTERS---------------------------------->*
********************************************************************************
*                                                                              *
*                                                                              *
*                              ACTION AREA                                     *
*                                                                              *
********************************************************************************
```

Figure 4.7 Panel Structure

that a user sees when signing on the system, is one that requires the individual to insure that he/she has the computer in the proper mode (Figure 4.8)

D. SECURITY

Security is provided in two ways. First, the system requires the user to enter a user ID and password which are stored as attributes of



```
TEST
                INFORMATION RESOURCE DICTIONARY SYSTEM

                        PLEASE INSURE THAT YOU
                        HAVE THE ' CAPS LOCK '
                        ON AS ALL ANSWERS TO
                        QUESTIONS NEED TO BE
                        IN UPPER CASE.

                        TEST HERE
                        PRESS RETURN TO CONTINUE
```

Figure 4.8 Initial Panel

the SECURITY-ACCESS ENTITY. Second, the SECURITY-ACCESS ENTITY contains additional attributes that pertain to which entities the user can view, display and/or modify (See Appendix F for a detailed description the entity structure). Figure 4.9 depicts the panel that requires the user to log into the system using his user ID and password. Once a user has entered his ID and password the system will grant or deny access to the system. The system will allow the user three chances to enter his ID and password correctly, if a proper logon has not been accomplished at that time the system will terminate. If access is granted additional variables will be loaded to the system that will restrict the user ability to add, modify and change relations and relationships during the current session. The data administrator is the only user capable of modifying the attributes associated with a user's security-access entity. Once the user has successfully logged in, the system will display the main menu (Figure 4.10). From this point the user can proceed to any other panel. This panel must always be returned before any other function can be used.

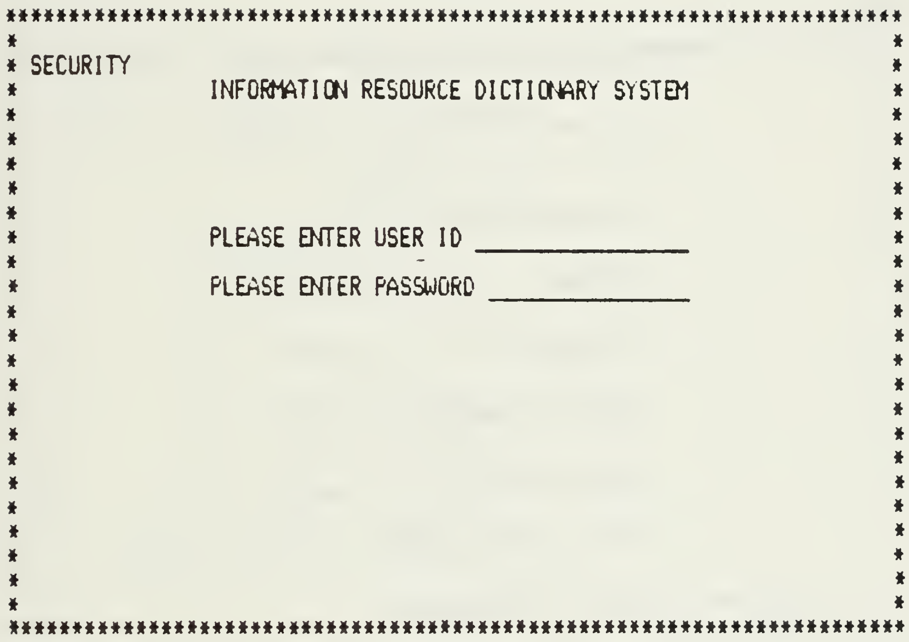
E. POPULATING AND MAINTAINING THE DICTIONARY

The routines to add, modify and delete entities and relationships are executed from the maintenance menu (See Figure 4.11). The user decides which maintenance activity he want to do and makes the appropriate menu selection. The system will then activate the appropriate maintenance module and present a panel to the user showing him what his options are or what input is required.

The following sections describe each of the five dictionary maintenance functions available to the user as part of the prototype.

1. Adding Entities

If the prototype user selects the add entity option from the maintenance menu, the system will prompt him as to which type of entity he would like to add (See Figure 4.12). Once the user has indicated his

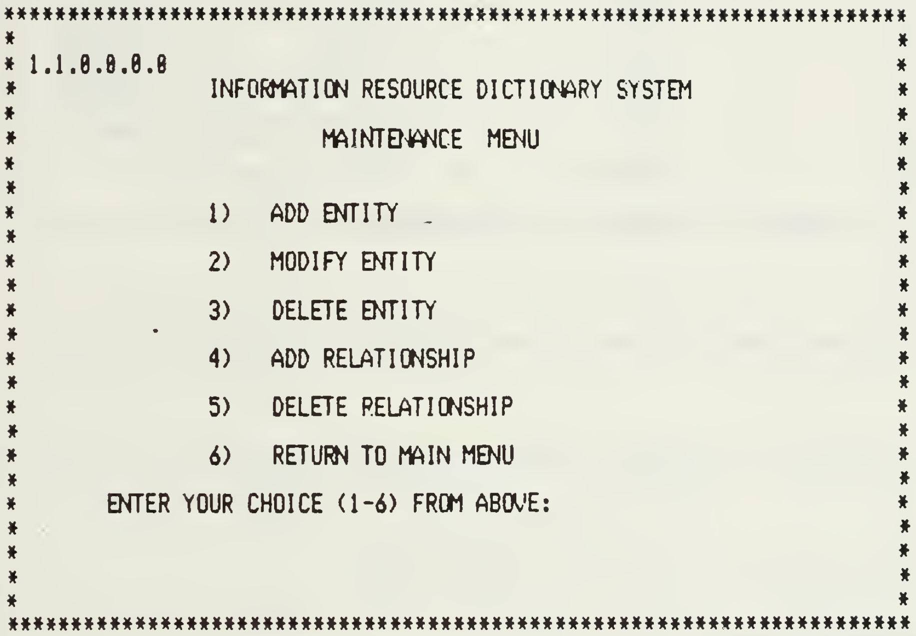


```
* SECURITY
                INFORMATION RESOURCE DICTIONARY SYSTEM



                PLEASE ENTER USER ID _________________

                PLEASE ENTER PASSWORD ________________
```

Figure 4.9 Security Panel

```
*************************************************************************
*                                                                       *
* MAIN                                                                  *
*               INFORMATION RESOURCE DICTIONARY SYSTEM                  *
*                                                                       *
*                              MAIN MENU                                *
*                                                                       *
*                                                                       *
*               1)    DICTIONARY MAINTENANCE                            *
*                                                                       *
*               2)    DICTIONARY OUTPUT                                 *
*                                                                       *
*               3)    DICTIONARY QUERY                                  *
*                                                                       *
*               4)    SCHEMA MAINTENANCE                                *
*                                                                       *
*               5)    SCHEMA OUTPUT                                     *
*                                                                       *
*               6)    EXIT DICTIONARY SYSTEM                            *
*                                                                       *
*       ENTER YOUR CHOICE (1-6) FROM ABOVE:                             *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*************************************************************************
```

Figure 4.10 Main IRDS Panel



```
***************************************************************************
*                                                                         *
* 1.1.0.0.0.0                                                             *
*              INFORMATION RESOURCE DICTIONARY SYSTEM                     *
*                                                                         *
*                        MAINTENANCE  MENU                                *
*                                                                         *
*                                                                         *
*              1)   ADD ENTITY                                            *
*                                                                         *
*              2)   MODIFY ENTITY                                         *
*                                                                         *
*              3)   DELETE ENTITY                                         *
*                                                                         *
*              4)   ADD RELATIONSHIP                                      *
*                                                                         *
*              5)   DELETE RELATIONSHIP                                   *
*                                                                         *
*              6)   RETURN TO MAIN MENU                                   *
*                                                                         *
*        ENTER YOUR CHOICE (1-6) FROM ABOVE:                              *
*                                                                         *
*                                                                         *
*                                                                         *
*                                                                         *
***************************************************************************
```

Figure 4.11 Maintenance Panel

choice, the system will present a panel prompting the user to enter the appropriate attributes about the entity (See Figure 4.13). For a

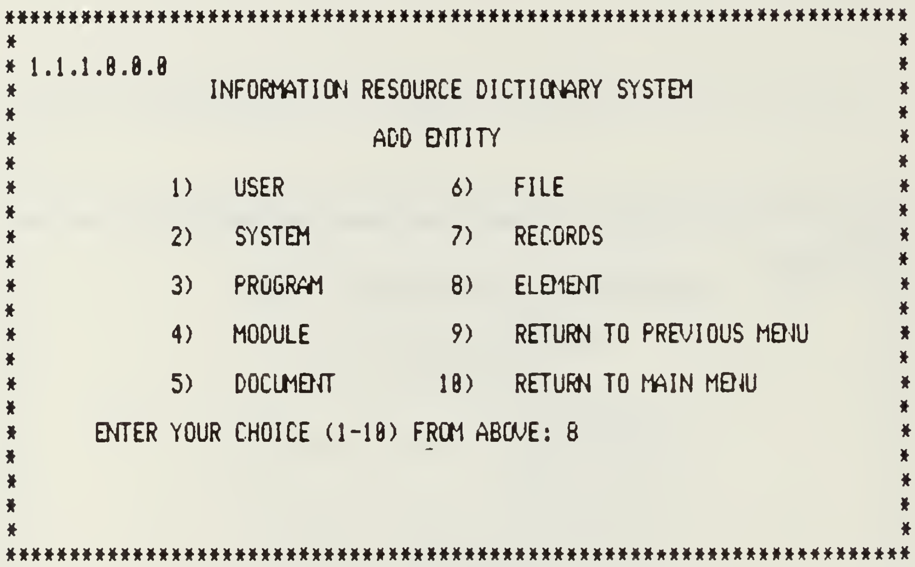
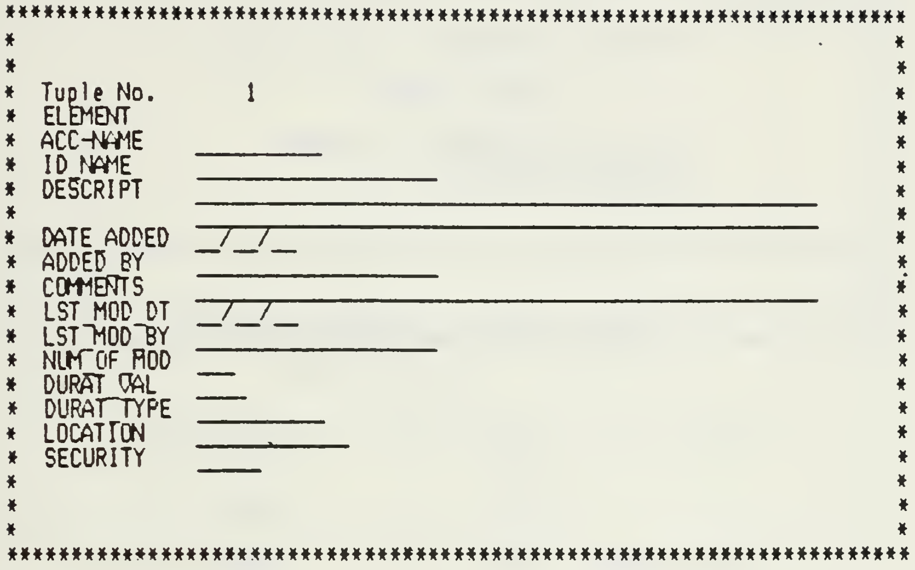

```
**************************************************************************
*                                                                        *
* 1.1.1.0.0.0                                                            *
*                INFORMATION RESOURCE DICTIONARY SYSTEM                  *
*                                                                        *
*                              ADD ENTITY                                *
*                                                                        *
*          1)   USER              6)   FILE                              *
*                                                                        *
*          2)   SYSTEM            7)   RECORDS                           *
*                                                                        *
*          3)   PROGRAM           8)   ELEMENT                           *
*                                                                        *
*          4)   MODULE            9)   RETURN TO PREVIOUS MENU           *
*                                                                        *
*          5)   DOCUMENT         10)   RETURN TO MAIN MENU               *
*                                                                        *
*     ENTER YOUR CHOICE (1-10) FROM ABOVE: 8                             *
*                                                                        *
*                                                                        *
*                                                                        *
*                                                                        *
**************************************************************************
```

Figure 4.12 Add Entity Panel

complete list of all allowable entity attributes See Appendix A.

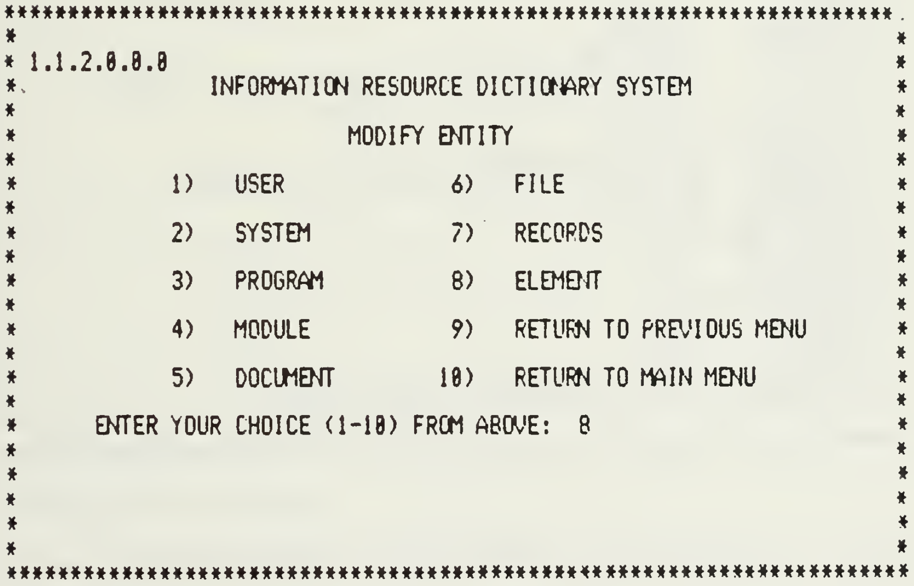
2. <u>Modifying Entities</u>

If the prototype user elects to modify an existing entity, the system display a panel asking which entity he desires to modify (Figure 4.14 and 4.15). Once the user makes his selection as to which entity to modify the system restrieves the desired tuple and presents a panel displaying it's current contents. The user can then modify the tuple as desired (Figure 4.16)



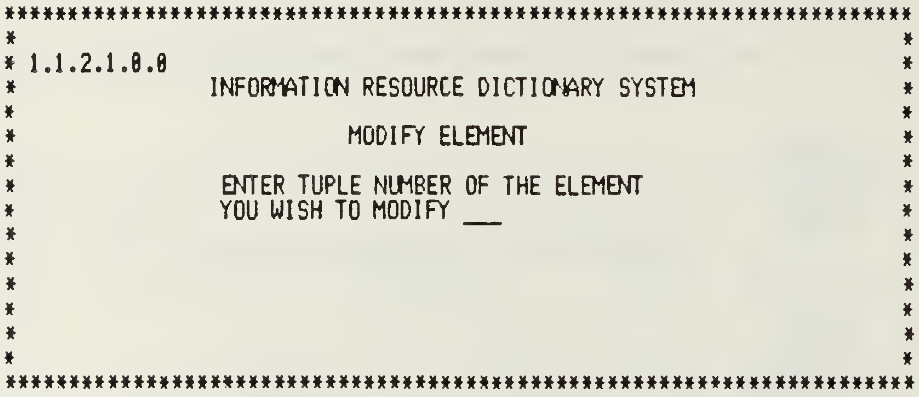
```
**************************************************************************
*                                                                        *
*                                                                        *
*  Tuple No.      1                                                      *
*  ELEMENT                                                               *
*  ACC-NAME     __________                                               *
*  ID NAME      __________________                                       *
*  DESCRIPT     __________________________________________________       *
*               __________________________________________________       *
*  DATE ADDED   _/_/_                                                    *
*  ADDED BY     __________________                                       *
*  COMMENTS     __________________________________________________       *
*  LST MOD DT   _/_/_                                                    *
*  LST MOD BY   __________________                                       *
*  NUM OF MOD   ___                                                      *
*  DURAT VAL    ____                                                     *
*  DURAT TYPE   __________                                               *
*  LOCATION     ____________                                             *
*  SECURITY     _____                                                    *
*                                                                        *
*                                                                        *
*                                                                        *
**************************************************************************
```

Figure 4.13 Add Entity Data Input Panel



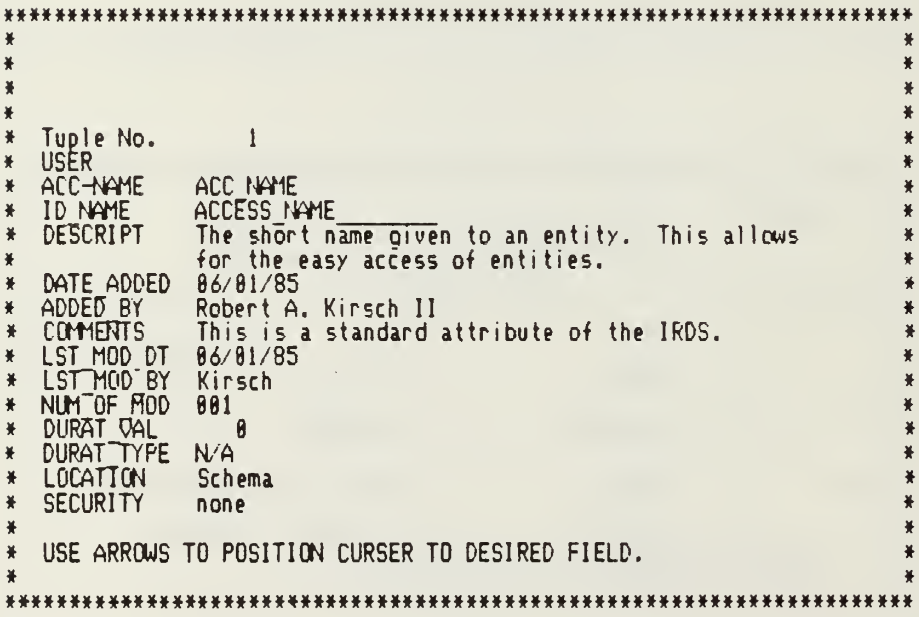
```
**************************************************************************
*                                                                        *
* 1.1.2.0.0.0                                                            *
*                 INFORMATION RESOURCE DICTIONARY SYSTEM                 *
*                                                                        *
*                            MODIFY ENTITY                               *
*                                                                        *
*          1)   USER               6)   FILE                             *
*                                                                        *
*          2)   SYSTEM             7)   RECORDS                          *
*                                                                        *
*          3)   PROGRAM            8)   ELEMENT                          *
*                                                                        *
*          4)   MODULE             9)   RETURN TO PREVIOUS MENU          *
*                                                                        *
*          5)   DOCUMENT          10)   RETURN TO MAIN MENU              *
*                                                                        *
*      ENTER YOUR CHOICE (1-10) FROM ABOVE:  8                           *
*                                                                        *
*                                                                        *
*                                                                        *
*                                                                        *
*                                                                        *
**************************************************************************
```

Figure 4.14 Modify Entity Panel



```
************************************************************************
*                                                                      *
* 1.1.2.1.0.0                                                          *
*                INFORMATION RESOURCE DICTIONARY SYSTEM                *
*                                                                      *
*                          MODIFY ELEMENT                              *
*                                                                      *
*                 ENTER TUPLE NUMBER OF THE ELEMENT                    *
*                 YOU WISH TO MODIFY __                                *
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
************************************************************************
```

Figure 4.15 Modify Entity Select Panel

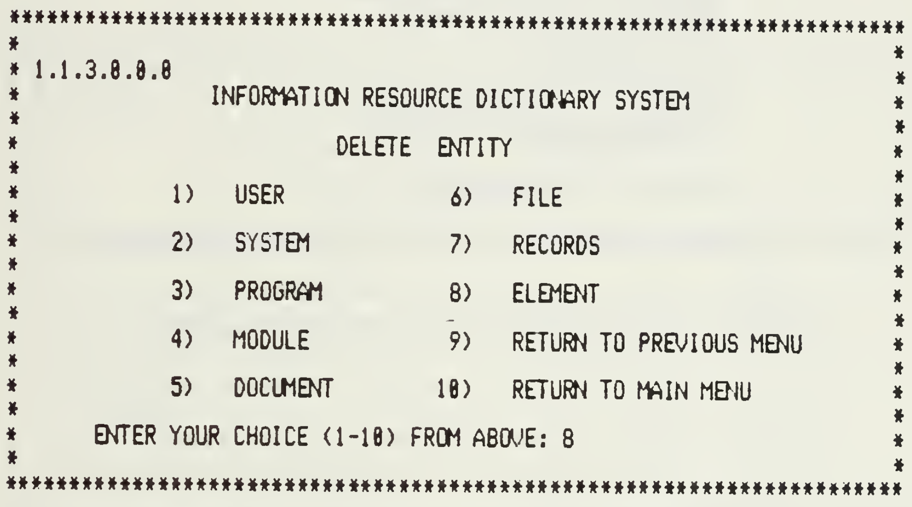


```
************************************************************************
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
*  Tuple No.       1                                                   *
*  USER                                                                *
*  ACC-NAME     ACC_NAME                                               *
*  ID_NAME      ACCESS_NAME________                                    *
*  DESCRIPT     The short name given to an entity.  This allows        *
*               for the easy access of entities.                       *
*  DATE_ADDED   06/01/85                                               *
*  ADDED_BY     Robert A. Kirsch II                                    *
*  COMMENTS     This is a standard attribute of the IRDS.              *
*  LST_MOD_DT   06/01/85                                               *
*  LST_MOD_BY   Kirsch                                                 *
*  NUM_OF_MOD   001                                                    *
*  DURAT_VAL      0                                                    *
*  DURAT_TYPE   N/A                                                    *
*  LOCATION     Schema                                                 *
*  SECURITY     none                                                   *
*                                                                      *
*  USE ARROWS TO POSITION CURSER TO DESIRED FIELD.                     *
*                                                                      *
************************************************************************
```

Figure 4.16 Modify Entity Input Panel

3. Deleting Entities

If the prototype user selects the delete entity option, the system presents a panel requesting that the user select an entity type to delete.



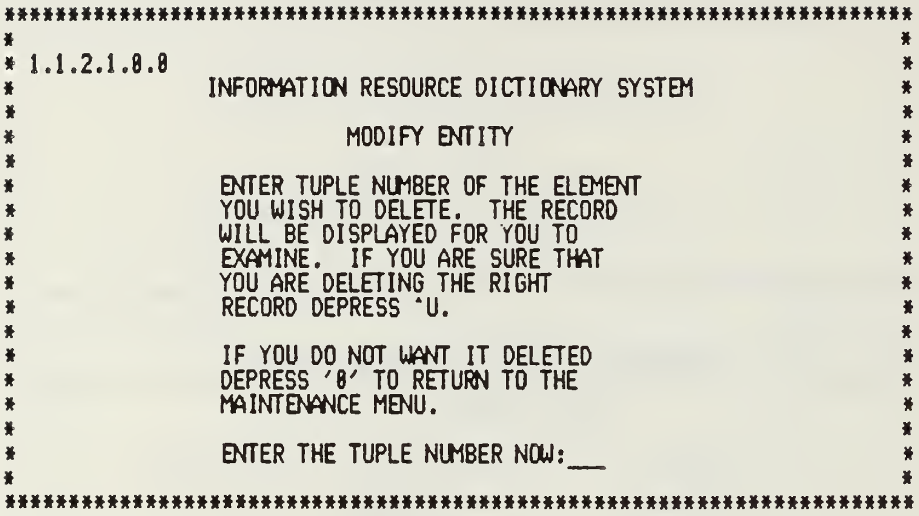
```
***********************************************************************
*                                                                     *
* 1.1.3.0.0.0                                                         *
*              INFORMATION RESOURCE DICTIONARY SYSTEM                 *
*                                                                     *
*                       DELETE  ENTITY                                *
*                                                                     *
*          1)   USER               6)   FILE                          *
*                                                                     *
*          2)   SYSTEM             7)   RECORDS                       *
*                                                                     *
*          3)   PROGRAM            8)   ELEMENT                       *
*                                                                     *
*          4)   MODULE             9)   RETURN TO PREVIOUS MENU       *
*                                                                     *
*          5)   DOCUMENT          10)   RETURN TO MAIN MENU           *
*                                                                     *
*     ENTER YOUR CHOICE (1-10) FROM ABOVE: 8                          *
*                                                                     *
***********************************************************************
```

Figure 4.17 Delete Entity Panel

The system then request the user to identify the particular entity tuple to be deleted and provided instructions on how to complete or short the deletion. Once the user indicates which tuple he wishes to delete, the system displays the tuple and waits for the user to complete the transaction (Figure 4.16 thru 4.18)

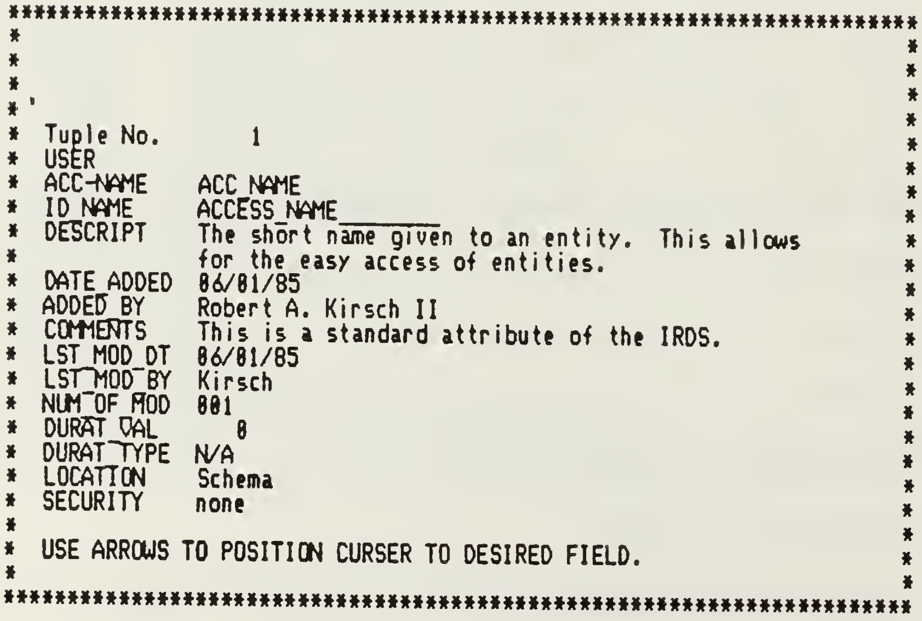
4. Adding Relationships

If the prototype user elects to add a relationship the system present a panel asking him to select which type of relationship he wishes



```
************************************************************************
*                                                                      *
* 1.1.2.1.0.0                                                          *
*              INFORMATION RESOURCE DICTIONARY SYSTEM                  *
*                                                                      *
*                          MODIFY ENTITY                               *
*                                                                      *
*               ENTER TUPLE NUMBER OF THE ELEMENT                      *
*               YOU WISH TO DELETE.  THE RECORD                        *
*               WILL BE DISPLAYED FOR YOU TO                           *
*               EXAMINE.  IF YOU ARE SURE THAT                         *
*               YOU ARE DELETING THE RIGHT                             *
*               RECORD DEPRESS ^U.                                     *
*                                                                      *
*               IF YOU DO NOT WANT IT DELETED                          *
*               DEPRESS '0' TO RETURN TO THE                           *
*               MAINTENANCE MENU.                                      *
*                                                                      *
*               ENTER THE TUPLE NUMBER NOW:___                         *
*                                                                      *
************************************************************************
```

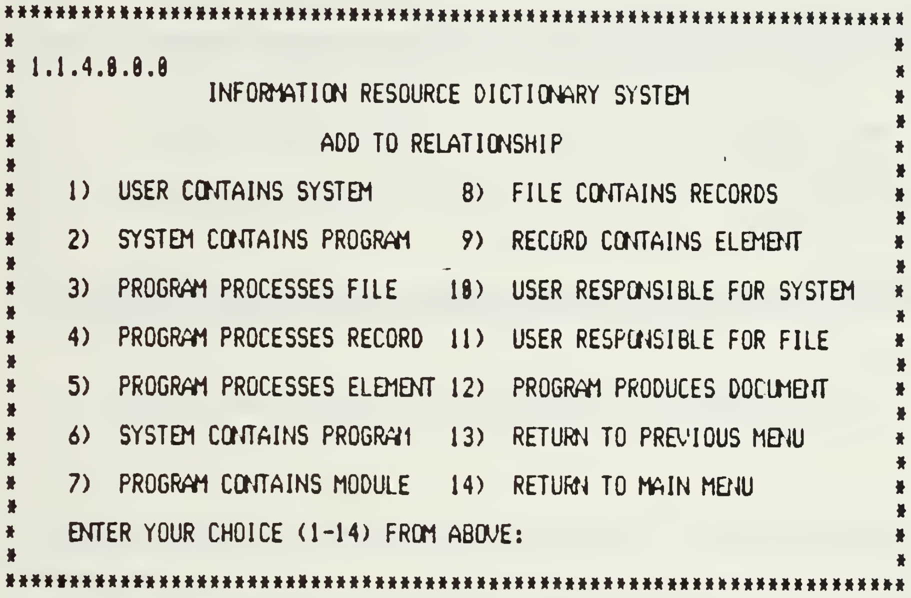
Figure 4.18 Delete Entity Selection Panel



```
************************************************************************
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
*  Tuple No.      1                                                    *
*  USER                                                                *
*  ACC-NAME     ACC_NAME                                               *
*  ID_NAME      ACCESS_NAME_______                                     *
*  DESCRIPT     The short name given to an entity.  This allows        *
*               for the easy access of entities.                       *
*  DATE_ADDED   06/01/85                                               *
*  ADDED_BY     Robert A. Kirsch II                                    *
*  COMMENTS     This is a standard attribute of the IRDS.              *
*  LST_MOD_DT   06/01/85                                               *
*  LST_MOD_BY   Kirsch                                                 *
*  NUM_OF_MOD   001                                                    *
*  DURAT_VAL      0                                                    *
*  DURAT_TYPE   N/A                                                    *
*  LOCATION     Schema                                                 *
*  SECURITY     none                                                   *
*                                                                      *
*  USE ARROWS TO POSITION CURSER TO DESIRED FIELD.                     *
*                                                                      *
************************************************************************
```

Figure 4.19 Delete Entity Confirmation Panel

to add (Figure 4.20). When the user makes his choice the system executes the relationship add module and prompts the user for the required input (Figure 4.21) This prototype version allows 12 relationships. See Appendix A for a complete list of all relationships allowed in the IRDS standard.



```
************************************************************************
*                                                                      *
* 1.1.4.0.0.0                                                          *
*              INFORMATION RESOURCE DICTIONARY SYSTEM                  *
*                                                                      *
*                       ADD TO RELATIONSHIP                            *
*                                                                      *
*   1)  USER CONTAINS SYSTEM        8)  FILE CONTAINS RECORDS          *
*                                                                      *
*   2)  SYSTEM CONTAINS PROGRAM     9)  RECORD CONTAINS ELEMENT        *
*                                                                      *
*   3)  PROGRAM PROCESSES FILE     10)  USER RESPONSIBLE FOR SYSTEM    *
*                                                                      *
*   4)  PROGRAM PROCESSES RECORD   11)  USER RESPONSIBLE FOR FILE      *
*                                                                      *
*   5)  PROGRAM PROCESSES ELEMENT  12)  PROGRAM PRODUCES DOCUMENT      *
*                                                                      *
*   6)  SYSTEM CONTAINS PROGRAM    13)  RETURN TO PREVIOUS MENU        *
*                                                                      *
*   7)  PROGRAM CONTAINS MODULE    14)  RETURN TO MAIN MENU            *
*                                                                      *
*   ENTER YOUR CHOICE (1-14) FROM ABOVE:                               *
*                                                                      *
************************************************************************
```

Figure 4.20 Add Relationship Selection Panel

5. Modifying Relationships

This version of the IRDS prototype does not contain a modify relationship capability as the add relationship module serves the same purpose.

6. Deleting Relationships

This module of the IRDS prototype allows the user to select a tuple of a particular relationship and mark it for deletion. The user

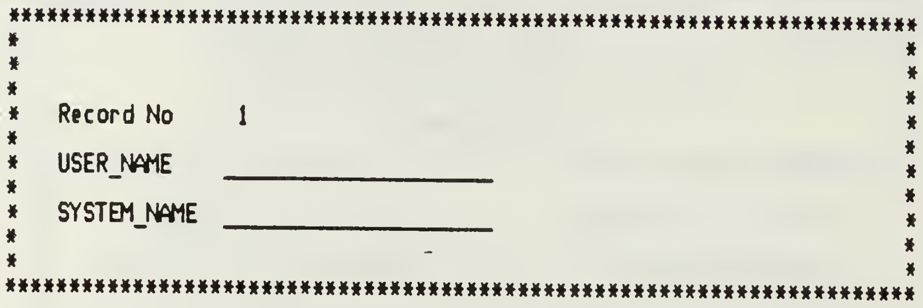

```
Record No      1
USER_NAME      ________________
SYSTEM_NAME    ________________
```

Figure 4.21 Add Relationship Input Panel

must identify which type of relationship he want to modify (Figure 4.24). After the user makes a selection, the delete module is loaded which prompts the user to identify which tuple to delete and provides him with instructions on how to complete the transaction. The system then retrieves the tuple and displays it for verification and transaction completion (See Figures 4.25 and 4.26).

F. THE DICTIONARY OUTPUT FACILITY

The IRDS prototype allows the user to generate dictionary output in two forms, screen and printer. When the user selects the dictionary output

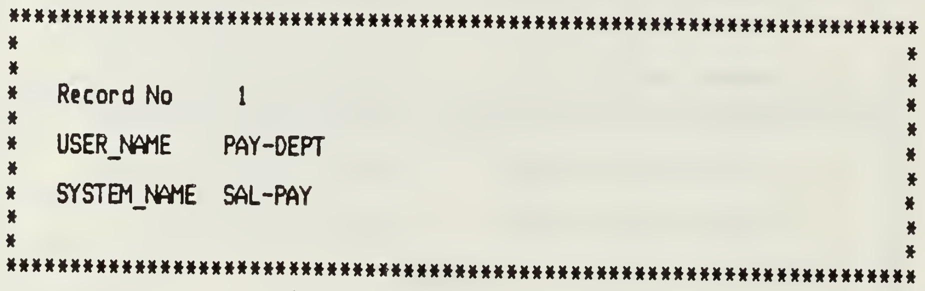
```
***********************************************************************
*                                                                     *
* 1.1.5.0.0.0                                                         *
*               INFORMATION RESOURCE DICTIONARY SYSTEM                *
*                                                                     *
*                     DELETE FROM RELATIONSHIP                        *
*                                                                     *
*   1)  USER CONTAINS SYSTEM        8)  FILE CONTAINS RECORDS         *
*                                                                     *
*   2)  SYSTEM CONTAINS PROGRAM     9)  RECORD CONTAINS ELEMENT       *
*                                                                     *
*   3)  PROGRAM PROCESSES FILE     10)  USER RESPONSIBLE FOR SYSTEM   *
*                                                                     *
*   4)  PROGRAM PROCESSES RECORD   11)  USER RESPONSIBLE FOR FILE     *
*                                                                     *
*   5)  PROGRAM PROCESSES ELEMENT  12)  PROGRAM PRODUCES DOCUMENT     *
*                                                                     *
*   6)  SYSTEM CONTAINS PROGRAM    13)  RETURN TO PREVIOUS MENU       *
*                                                                     *
*   7)  PROGRAM CONTAINS MODULE    14)  RETURN TO MAIN MENU           *
*                                                                     *
*   ENTER YOUR CHOICE (1-14) FROM ABOVE:                              *
*                                                                     *
*                                                                     *
*                               _                                     *
***********************************************************************
```

Figure 4.24 Delete Relationship Selection Panel

```
***********************************************************************
*                                                                     *
* 1.1.5.1.0.0                                                         *
*               INFORMATION RESOURCE DICTIONARY SYSTEM                *
*                                                                     *
*                    DELETE FROM RELATIONSHIP                         *
*                                                                     *
*             ENTER TUPLE NUMBER OF THE                               *
*                                                                     *
*                USER-PROCESSES-SYSTEM                                *
*                                                                     *
*             TUPLE THAT YOU WISH TO HAVE DELETED                     *
*             THE TUPLE WILL BE DISPLAYED FOR                         *
*             YOU TO EXAMINE.  IF YOU ARE SURE                        *
*             THAT TOU ARE DELETING THE RIGHT                         *
*             TUPLE DEPRESS  ^U .  IF YOU DO NOT                      *
*             WANT IT DELETED, TYPE  ^ END . IF                       *
*             YOU WANT TO EXIT THE MODULE WITHOUT                     *
*             IDENTIFYING A TUPLE DEPRESS 0 TO                        *
*             RETURN TO THE PREVIOUS MENU.                            *
*                                                                     *
*             ENTER THE TUPLE NUMBER NOW __                           *
*                                                                     *
***********************************************************************
```

Figure 4.25 Delete Relationship Panel

option from the main menu, the system executes the dictionary output module and presents to the user a panel (Figure 4.27) requesting that he choose entities or relationships as output.

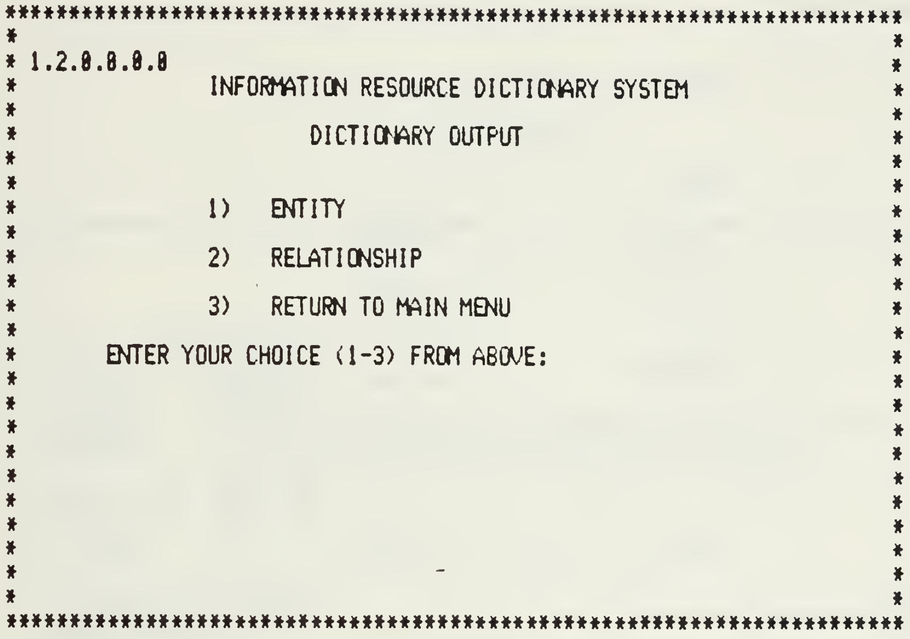


```
Record No      1

USER_NAME      PAY-DEPT

SYSTEM_NAME    SAL-PAY
```

Figure 4.26 Delete Relationship Tuple Verification Panel

1. <u>Entities</u>

If the user chooses the entity output option, the system presents a panel requesting the type of entity to be output (Figure 4.28). The system then prompts for whether output is to be generated and displayed on the screen or sent to the printer (Figure 4.29). The system then displays all tuples of the entity-type selected, one at a time for screen output and all at once for printer output (Figure 4.30). The current version of the IRDS prototype does not allow the user to select which attributes will be displayed or limit the number of entities displayed. However the query function does give the user the ability to display selected entity types. This capability will be discussed in Section G.



```
************************************************************************
*                                                                      *
* 1.2.0.0.0.0                                                          *
*                   INFORMATION RESOURCE DICTIONARY SYSTEM             *
*                                                                      *
*                          DICTIONARY OUTPUT                           *
*                                                                      *
*                                                                      *
*                   1)   ENTITY                                        *
*                                                                      *
*                   2)   RELATIONSHIP                                  *
*                                                                      *
*                   3)   RETURN TO MAIN MENU                           *
*                                                                      *
*          ENTER YOUR CHOICE (1-3) FROM ABOVE:                         *
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
*                                   -                                  *
*                                                                      *
************************************************************************
```

Figure 4.27 Dictionary Output Selection Panel

2. Relationships

If the prototype user decides to output the tuples associated with a particular relationship, he makes the appropriate choice on the dictionary output panel (Figure 4.27). The system activates the appropriate module and then requests that the user identify the relationship to be output (See Figure 4.31. After the user selects the relationship, the system prompts for whether output is to be generated to the screen or printer (Figure 4.32). The system then displays all tuples of the entity-type selected (Figure 4.33). This version of the IRDS prototype does not allow the user to select which entities associated with the relationship are to be displayed. However the query function does give the user the ability to display selected entities with a relationship.

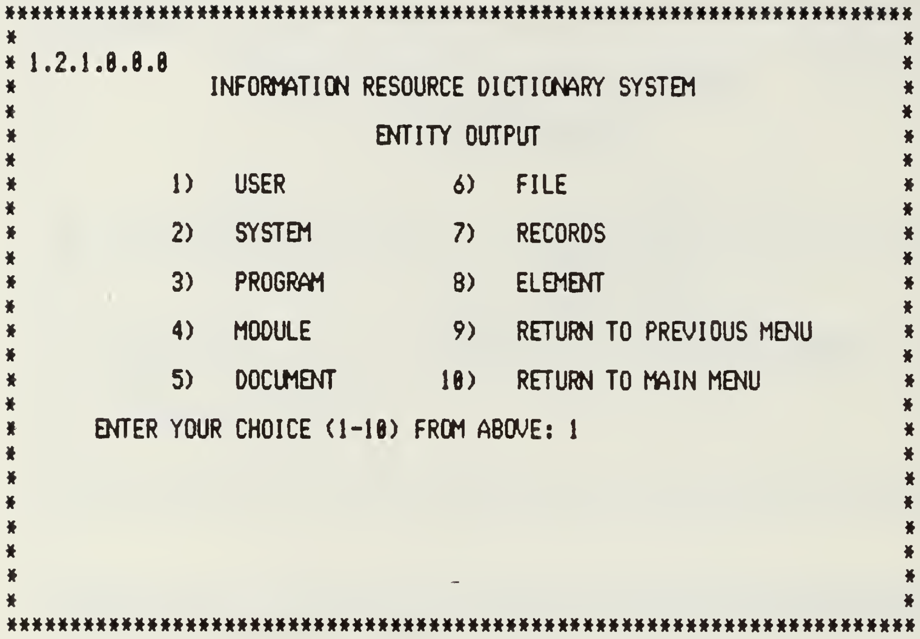

```
*************************************************************************
*                                                                       *
* 1.2.1.0.0.0                                                           *
*                INFORMATION RESOURCE DICTIONARY SYSTEM                 *
*                                                                       *
*                            ENTITY OUTPUT                              *
*                                                                       *
*          1)   USER               6)   FILE                            *
*                                                                       *
*          2)   SYSTEM             7)   RECORDS                         *
*                                                                       *
*          3)   PROGRAM            8)   ELEMENT                         *
*                                                                       *
*          4)   MODULE             9)   RETURN TO PREVIOUS MENU         *
*                                                                       *
*          5)   DOCUMENT          10)   RETURN TO MAIN MENU             *
*                                                                       *
*      ENTER YOUR CHOICE (1-10) FROM ABOVE: 1                           *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*************************************************************************
```

Figure 4.28 Entity Output Panel

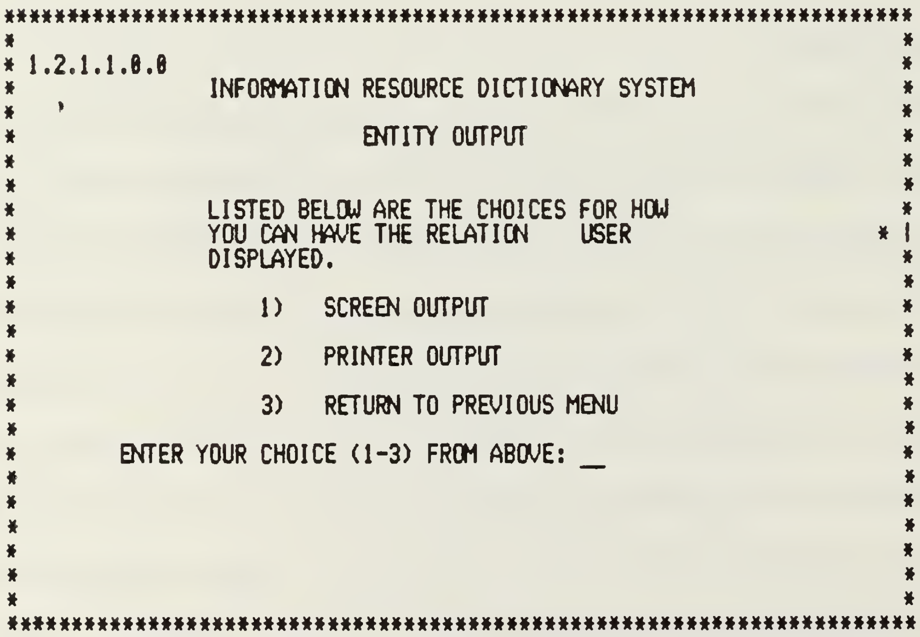

```
*************************************************************************
*                                                                       *
* 1.2.1.1.0.0                                                           *
*                INFORMATION RESOURCE DICTIONARY SYSTEM                 *
*                                                                       *
*                            ENTITY OUTPUT                              *
*                                                                       *
*                                                                       *
*                LISTED BELOW ARE THE CHOICES FOR HOW                   *
*                YOU CAN HAVE THE RELATION    USER                      *
*                DISPLAYED.                                             *
*                                                                       *
*                    1)   SCREEN OUTPUT                                 *
*                                                                       *
*                    2)   PRINTER OUTPUT                                *
*                                                                       *
*                    3)   RETURN TO PREVIOUS MENU                       *
*                                                                       *
*       ENTER YOUR CHOICE (1-3) FROM ABOVE: __                          *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*************************************************************************
```

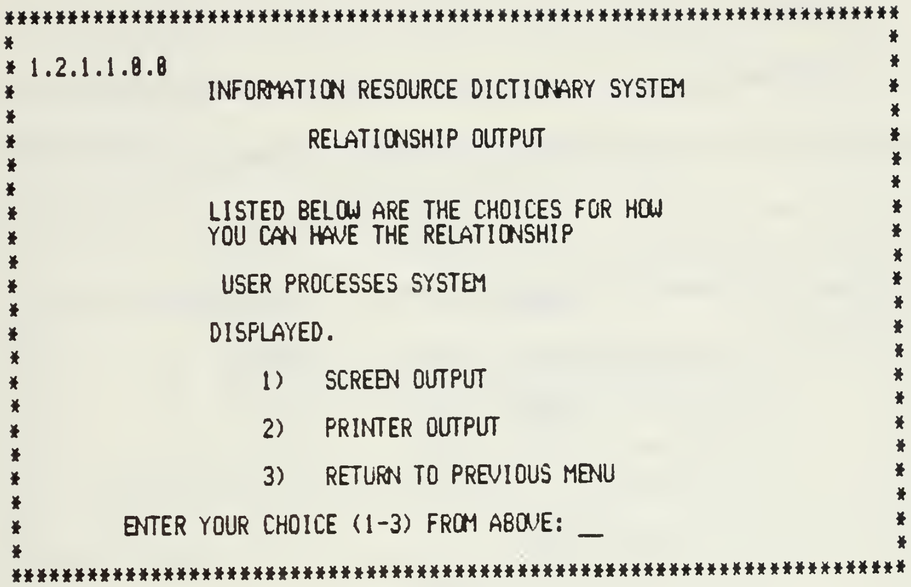
Figure 4.29 Output Selection Panel

```
************************************************************************
*                                                                      *
*                                                                      *
*                                                                      *
*                                                                      *
*  Tuple No.       1                                                   *
*  USER                                                                *
*  ACC-NAME     PAY-DEPT                                               *
*  ID_NAME      PAYROLL DEPARTMENT                                     *
*  DESCRIPT     The department within the organization that pro-       *
*               duces the companies weekly and monthly payroll.        *
*  DATE_ADDED   06/01/85                                               *
*  ADDED_BY     Robert A. Kirsch II                                    *
*  COMMENTS     This is a standard attribute of the IRDS.              *
*                                                                      *
*  LST_MOD_DT   06/01/85                                               *
*  LST_MOD_BY   Kirsch                                                 *
*  NUM_OF_MOD   001                                                    *
*  LOCATION     Schema                                                 *
*  SECURITY     none                                                   *
*                                                                      *
*  PRESS RETURN TO SEE THE NEXT TUPLE.                                 *
*                                                                      *
*                                                                      *
************************************************************************
```

Figure 4.30 Entity Output

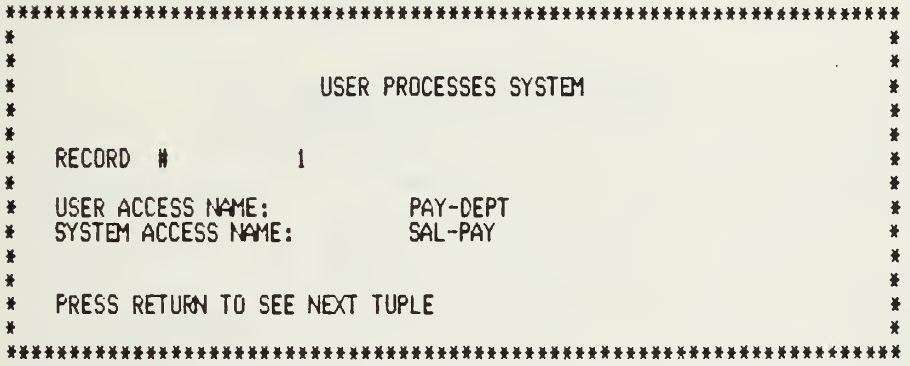
```
**************************************************************************
*                                                                        *
* 1.2.2.0.0.0                                                            *
*              INFORMATION RESOURCE DICTIONARY SYSTEM                    *
*                                                                        *
*                       RELATIONSHIP OUTPUT                              *
*                                                                        *
*    1)  USER CONTAINS SYSTEM         8)  FILE CONTAINS RECORDS          *
*                                                                        *
*    2)  SYSTEM CONTAINS PROGRAM      9)  RECORD CONTAINS ELEMENT        *
*                                                                        *
*    3)  PROGRAM PROCESSES FILE      10)  USER RESPONSIBLE FOR SYSTEM    *
*                                                                        *
*    4)  PROGRAM PROCESSES RECORD    11)  USER RESPONSIBLE FOR FILE      *
*                                                                        *
*    5)  PROGRAM PROCESSES ELEMENT   12)  PROGRAM PRODUCES DOCUMENT      *
*                                                                        *
*    6)  SYSTEM CONTAINS PROGRAM-    13)  RETURN TO PREVIOUS MENU        *
*                                                                        *
*    7)  PROGRAM CONTAINS MODULE     14)  RETURN TO MAIN MENU            *
*                                                                        *
*    ENTER YOUR CHOICE (1-14) FROM ABOVE:                                *
*                                                                        *
*                                                                        *
*                                                                        *
**************************************************************************
```

Figure 4.31 Relationship Ouptput Selection Panel



```
*********************************************************************
*                                                                   *
* 1.2.1.1.8.8                                                       *
*              INFORMATION RESOURCE DICTIONARY SYSTEM               *
*                                                                   *
*                     RELATIONSHIP OUTPUT                           *
*                                                                   *
*                                                                   *
*              LISTED BELOW ARE THE CHOICES FOR HOW                 *
*              YOU CAN HAVE THE RELATIONSHIP                        *
*                                                                   *
*               USER PROCESSES SYSTEM                               *
*                                                                   *
*              DISPLAYED.                                           *
*                                                                   *
*                  1)   SCREEN OUTPUT                               *
*                                                                   *
*                  2)   PRINTER OUTPUT                              *
*                                                                   *
*                  3)   RETURN TO PREVIOUS MENU                     *
*                                                                   *
*        ENTER YOUR CHOICE (1-3) FROM ABOVE: __                     *
*                                                                   *
*********************************************************************
```

Figure 4.32 Output Selection Panel

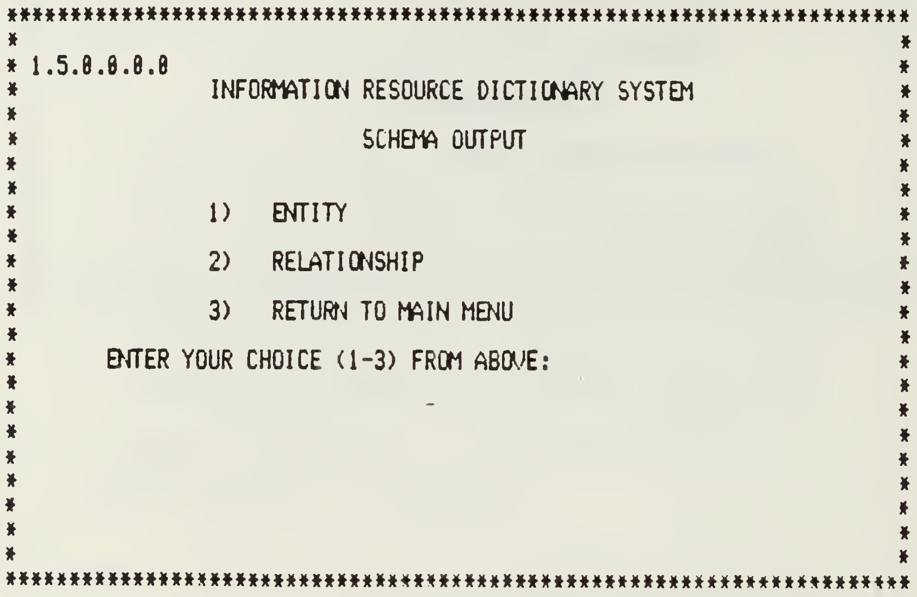


```
*********************************************************************
*                                                                   *
*                                                                   *
*                      USER PROCESSES SYSTEM                        *
*                                                                   *
*                                                                   *
*   RECORD  #          1                                            *
*                                                                   *
*   USER ACCESS NAME:            PAY-DEPT                           *
*   SYSTEM ACCESS NAME:          SAL-PAY                            *
*                                                                   *
*                                                                   *
*   PRESS RETURN TO SEE NEXT TUPLE                                  *
*                                                                   *
*********************************************************************
```

Figure 4.33 Relationship Output

3. Schema

The IRDS prototype also allows the user to display the schema for all entity-types and relationship-types. In order to execute this portion of the prototype the user selects SCHEMA OUTPUT from the main menu (Figure 4.10). Once the selection has been made,



```
*************************************************************************
*                                                                       *
* 1.5.0.0.0.0                                                           *
*              INFORMATION RESOURCE DICTIONARY SYSTEM                   *
*                                                                       *
*                         SCHEMA OUTPUT                                 *
*                                                                       *
*                                                                       *
*              1)   ENTITY                                              *
*                                                                       *
*              2)   RELATIONSHIP                                        *
*                                                                       *
*              3)   RETURN TO MAIN MENU                                 *
*                                                                       *
*        ENTER YOUR CHOICE (1-3) FROM ABOVE:                            *
*                                                                       *
*                            _                                          *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*************************************************************************
```

Figure 4.34 Schema Output Selection Panel

the system executes the schema output module and requests that the user choose which type of schema to output and it's ACCESS-NAME (Figure 4.34 and 4.35). The user is then prompted by means of a panel to select the output medium. The system will then display the requested schema structure (Figure 4.36 and 4.37). Figures 4.36 and 4.37 provided below depict the output of an entity-type schema. The process for displaying a re-relationship schema is identical and will not be explained further here.

G. QUERY

The IRDS prototype query function give the prototype user the ability to generate ad hoc queries about any relationships that the system

```
**********************************************************************
*                                                                    *
* 1.1.3.0.0.0                                                        *
*                INFORMATION RESOURCE DICTIONARY SYSTEM              *
*                                                                    *
*                        ENTITY SCHEMA OUTPUT                        *
*                                                                    *
*            1)   USER               6)   FILE                       *
*                                                                    *
*            2)   SYSTEM             7)   RECORDS                    *
*                                                                    *
*            3)   PROGRAM            8)   ELEMENT                    *
*                                                                    *
*            4)   MODULE             9)   RETURN TO PREVIOUS MENU    *
*                                                                    *
*            5)   DOCUMENT          10)   RETURN TO MAIN MENU        *
*                                                                    *
*      ENTER YOUR CHOICE (1-10) FROM ABOVE: 1                        *
*                                                                    *
*                                                                    *
**********************************************************************
```

Figure 4.35 Entity Select Panel

```
**********************************************************************
*                                                                    *
* 1.5.1.1.0.0                                                        *
*                INFORMATION RESOURCE DICTIONARY SYSTEM              *
*                                                                    *
*                       ENTITY SCHEMA OUTPUT                         *
*                                                                    *
*                                                                    *
*                LISTED BELOW ARE THE CHOICES FOR HOW                *
*                YOU CAN HAVE THE SCHEMA FOR RELATION                *
*                  USER  DISPLAYED.                                  *
*                                                                    *
*                    1)   SCREEN OUTPUT                              *
*                                                                    *
*                    2)   PRINTER OUTPUT                             *
*                                                                    *
*                    3)   RETURN TO PREVIOUS MENU                    *
*                                                                    *
*        ENTER YOUR CHOICE (1-3) FROM ABOVE: __                      *
*                                                                    *
*                                                                    *
**********************************************************************
```

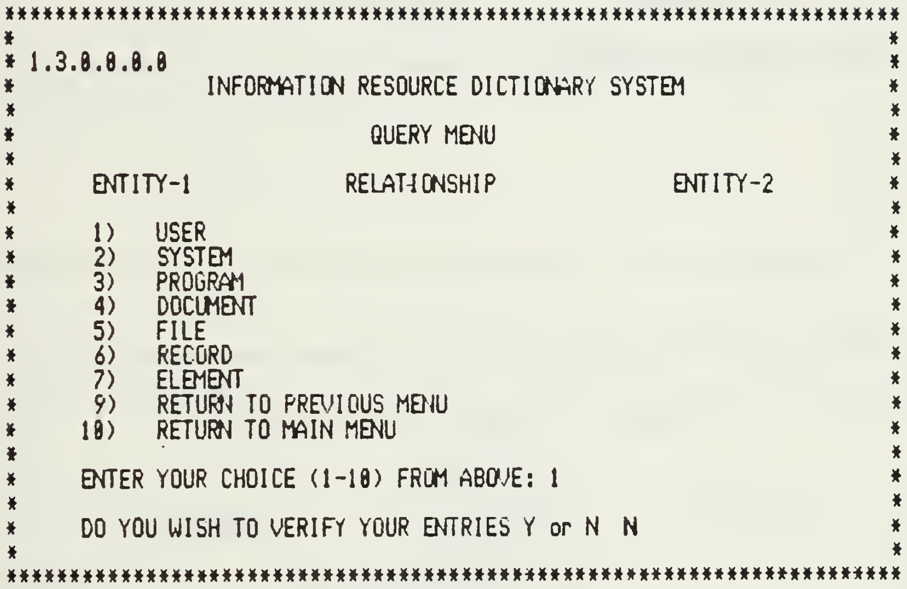
Figure 4.36 Output Selection Panel

maintains. Not all of the IRDS standard relationships are implemented in this version of the IRDS prototype (See Appendix A for a

```
*************************************************************************
*                                                                       *
*                                                                       *
*                                                                       *
*  Structure for database : C:USER.dbf                                  *
*  Number of data records :       7                                     *
*  Date of last update    : 08/06/85                                    *
*                                                                       *
*  Field   Field name    Type       Width      Dec                      *
*      1   USER          Logical        1                               *
*      2   ACC_NAME      Character     10                               *
*      3   ID_NAME       Character     20                               *
*      4   DESCRIPT      Character    100                               *
*      5   DATE_ADDED    Date           8                               *
*      6   ADDED_BY      Character     20                               *
*      7   COMMENTS      Character     50                               *
*      8   LST_MOD_DT    Date           8                               *
*      9   LST_MOD_BY    Character     20                               *
*     10   NUM_OF_MOD    Numeric        3                               *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*************************************************************************
```

Figure 4.37 Sample Schema Output

list of the allowable relationships). The remainder of the relationships will be reserved for implementation in subsequent versions of the prototype. The prototype uses a keyword selection process to generate a query of the form SUBJECT-VERB-OBJECT and a query processor to process the query and generate the resulting output. When the user selects the query option from the main menu (Figure 4.10), the system executes the query module and present a panel (See Figure 4.38) requesting that the user choice which entity-type is to be the subject of the query. The system then requires the user to enter the ACCESS-NAME of the entity to be queried and select whether entries are to be verified before



```
*************************************************************************
*                                                                       *
* 1.3.0.0.0.0                                                           *
*                INFORMATION RESOURCE DICTIONARY SYSTEM                 *
*                                                                       *
*                              QUERY MENU                               *
*                                                                       *
*      ENTITY-1              RELATIONSHIP              ENTITY-2         *
*                                                                       *
*      1)    USER                                                       *
*      2)    SYSTEM                                                     *
*      3)    PROGRAM                                                    *
*      4)    DOCUMENT                                                   *
*      5)    FILE                                                       *
*      6)    RECORD                                                     *
*      7)    ELEMENT                                                    *
*      9)    RETURN TO PREVIOUS MENU                                    *
*     10)    RETURN TO MAIN MENU                                        *
*                                                                       *
*     ENTER YOUR CHOICE (1-10) FROM ABOVE: 1                            *
*                                                                       *
*     DO YOU WISH TO VERIFY YOUR ENTRIES Y or N  N                      *
*                                                                       *
*************************************************************************
```

Figure 4.38 Query Entity-Type Selection Menu

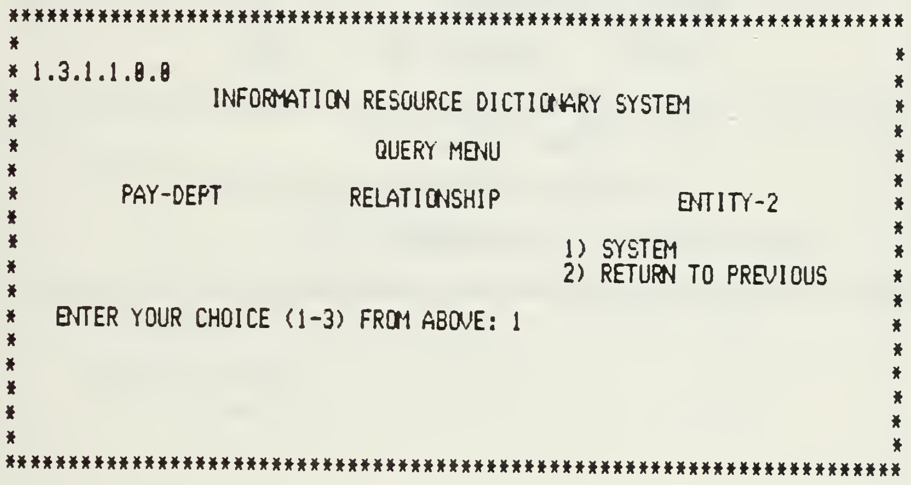
```
*************************************************************************
*                                                                       *
* 1.3.0.0.0.0                                                           *
*                INFORMATION RESOURCE DICTIONARY SYSTEM                 *
*                                                                       *
*                             QUERY MENU                                *
*                                                                       *
*         USER             RELATIONSHIP               ENTITY-2          *
*                                                                       *
*    ENTER THE ACCESS-NAME FOR THE   USER                               *
*    YOU WISH TO QUERY ON PRESS RETURN   ____PAY-DEPT____               *
*                                                                       *
*                                                                       *
*   IS THIS THE ENTITY YOU WISH TO QUERY ON   PAY-DEPT  Y OR N  _       *
*                                                                       *
*************************************************************************
```

Figure 4.39 Entity-1 Selection Menu

```
*************************************************************************
*                                                                       *
* 1.3.1.0.0.0                                                           *
*                INFORMATION RESOURCE DICTIONARY SYSTEM                 *
*                                                                       *
*                             QUERY MENU                                *
*                                                                       *
*       PAY-DEPT           RELATIONSHIP               ENTITY-2          *
*                                                                       *
*                          1)   CONTAINS                                *
*                          2)   IS RESPONSIBLE FOR                      *
*                          3)   RETURN TO PREVIOUS MENU                 *
*                                                                       *
*   ENTER YOUR CHOICE (1-3) FROM ABOVE: 2                               *
*                                                                       *
*                                                                       *
*                                                                       *
*                                                                       *
*************************************************************************
```

Figure 4.40 Relationship Selection Menu

being accepted by the system (Figure 4.39). The system next prompts the user for the relationship-type that is the verb of the query. Finally the system request the entity-type which acts as the object to form the query (Figures 4.40 and 4.41). When the final form of the



```
**************************************************************************
*                                                                        *
* 1.3.1.1.0.0                                                            *
*                 INFORMATION RESOURCE DICTIONARY SYSTEM                 *
*                                                                        *
*                              QUERY MENU                                *
*                                                                        *
*        PAY-DEPT            RELATIONSHIP                 ENTITY-2       *
*                                                                        *
*                                                1) SYSTEM               *
*                                                2) RETURN TO PREVIOUS   *
*                                                                        *
*   ENTER YOUR CHOICE (1-3) FROM ABOVE: 1                                *
*                                                                        *
*                                                                        *
*                                                                        *
*                                                                        *
**************************************************************************
```

Figure 4.41 Entity-2 Selection Menu

query has been specified the system process the query, requests the selection of an output medium for the query results, and then generates the output (See Figure 4.42 thru 4.43).

H. SCHEMA MAINTENANCE

Even though the Core IRDS Standard Schema limits entity and relationship meta-data (See Appendix A), it allows for extensibility in that additional attributes may be added by the user. The schema maintenance facility of the IRDS prototype allows an authorized (authorization is determined through the security function) user to add new attributes and modify or delete existing ones. Note: That although the prototype

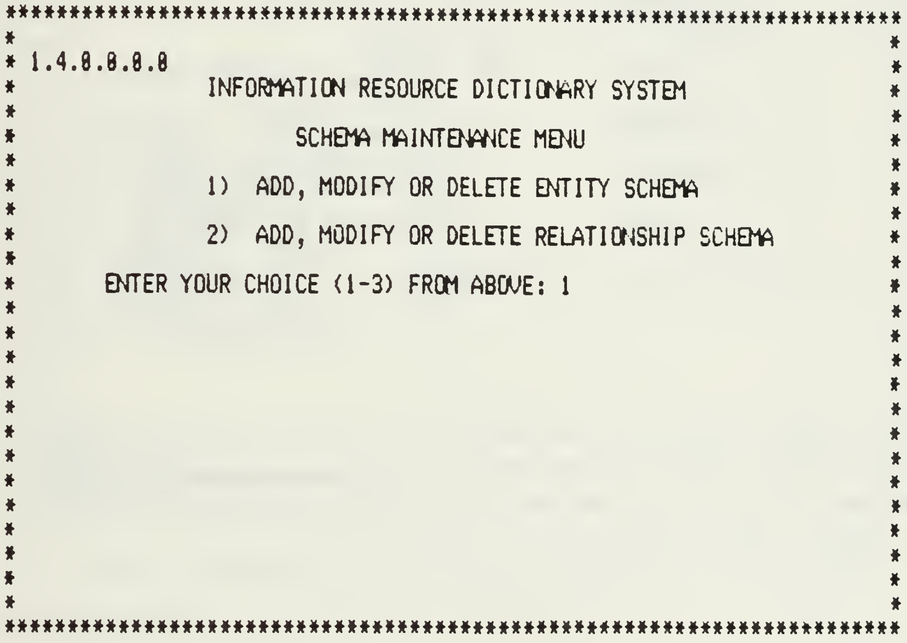
```
*****************************************************************************
* 1.2.1.1.0.0                                                               *
*                 INFORMATION RESOURCE DICTIONARY SYSTEM                    *
*                                                                           *
*                             ENTITY OUTPUT                                 *
*                                                                           *
*                                                                           *
*                 LISTED BELOW ARE THE CHOICES FOR HOW                      *
*                 YOU CAN HAVE THE QUERY                                    *
*                                                                           *
*                  PAY-DEPT    RESPONSIBLE FOR     SYSTEM                   *
*                                                                           *
*                     1)    SCREEN OUTPUT                                   *
*                                                                           *
*                     2)    PRINTER OUTPUT                                  *
*                                                                           *
*                     3)    RETURN TO PREVIOUS MENU                         *
*                                                                           *
*         ENTER YOUR CHOICE (1-3) FROM ABOVE: _                             *
*                                                                           *
*****************************************************************************
```

Figure 4.42 Output Selection Panel

```
*****************************************************************************
* 1.3.9.1.0.0                                                               *
*                 INFORMATION RESOURCE DICTIONARY SYSTEM                    *
*                                                                           *
*                             QUERY RESULTS FOR                             *
*                                                                           *
*                   PAY-DEPT  RESPONSIBLE FOR  SYSTEM                       *
*                                                                           *
*     IDENTIFICATION NAME:    SALARY PAYROLL                                *
*                                                                           *
*     DESCRIPTION:   This system is used to produce the monthly sal-        *
*                    sried payroll for the company.                         *
*                                                                           *
*     IDENTIFICATION NAME:    WEEKLY PAYROLL                                *
*                                                                           *
*     DESCRIPTION:   This system is used to produce the weekly pay-         *
*                    roll for the company.                                  *
*                                                                           *
*****************************************************************************
```

Figure 4.43 Query Result Panel

allows for the addition of entity and relationship relations the panel structure would require modification to make full use of any relations that were added. When the user selects the schema maintenance option from the main menu (See Figure 4.10), the system activates the schema maintenance module and displays a panel requesting that the user choose which type of schema is to be modified (Figure 4.44).



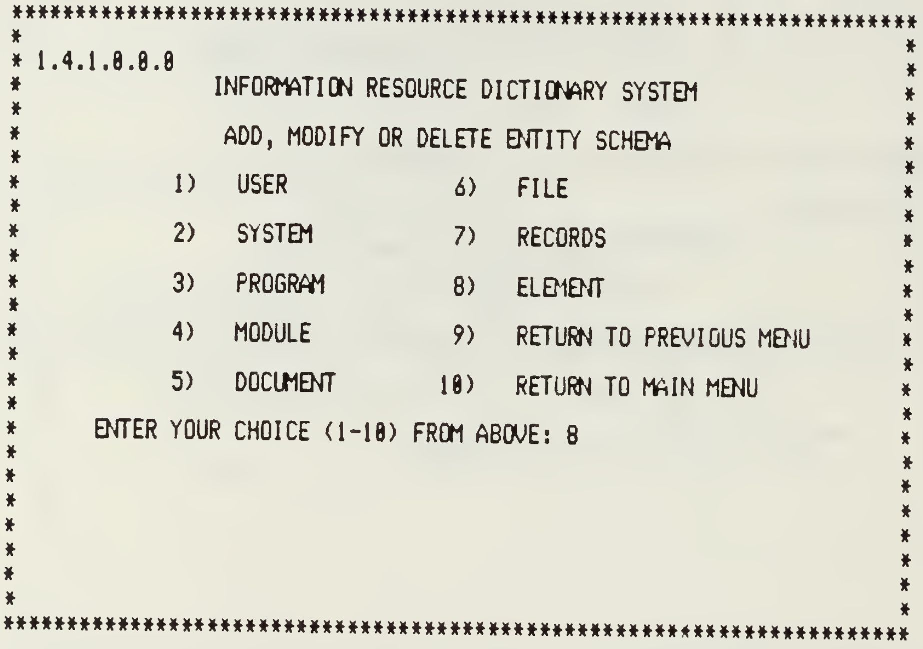
```
1.4.0.0.0.0
              INFORMATION RESOURCE DICTIONARY SYSTEM

                     SCHEMA MAINTENANCE MENU

              1)  ADD, MODIFY OR DELETE ENTITY SCHEMA

              2)  ADD, MODIFY OR DELETE RELATIONSHIP SCHEMA

        ENTER YOUR CHOICE (1-3) FROM ABOVE: 1
```

Figure 4.44 Schema Maintenance Selection Panel

The user will then be allowed to identify particular entity or relationship type and perform maintenance. The following sections describe how the IRDS prototype performs the schema maintenance functions of the IRDS prototype.

1. Entity Meta-data

When the authorized user indicates that he desires to add, modify or delete meta-data associated with the entity-type scema, the system presents a panel requesting that the user choose which entity he desires to maintain (Figure 4.45).



```
1.4.1.0.0.0
            INFORMATION RESOURCE DICTIONARY SYSTEM

             ADD, MODIFY OR DELETE ENTITY SCHEMA

          1)   USER              6)   FILE

          2)   SYSTEM            7)   RECORDS

          3)   PROGRAM           8)   ELEMENT

          4)   MODULE            9)   RETURN TO PREVIOUS MENU

          5)   DOCUMENT         10)   RETURN TO MAIN MENU

     ENTER YOUR CHOICE (1-10) FROM ABOVE: 8
```

Figure 4.45 Delete Entity Schema Maintenance Panel

a. Adding, Modifying or Deleting Entity Meta-data

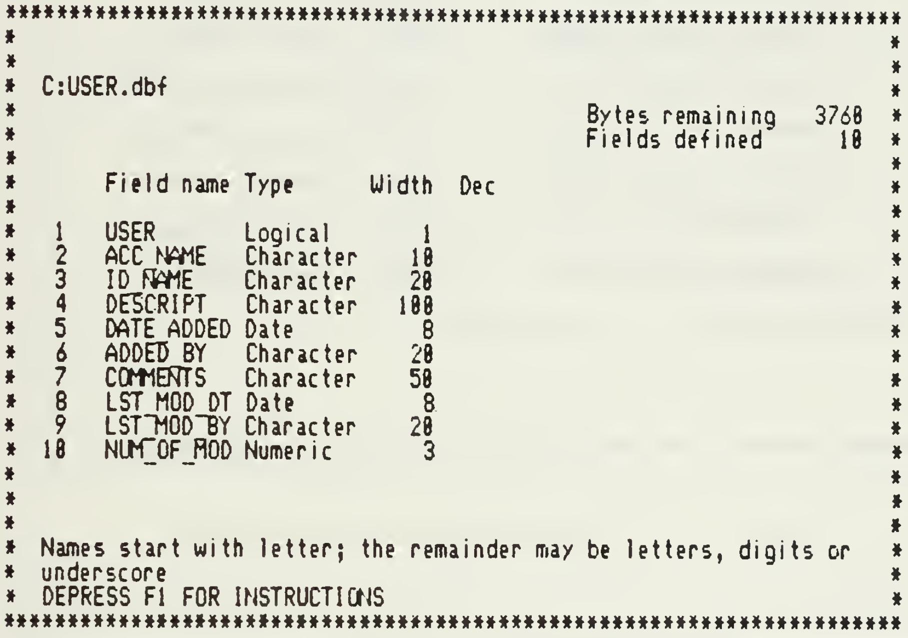
After the user identifies which entity-type is to be maintained, the system retrieves the schema structure, displays it, and allows the authorized user to perform the desired maintenance (See Figure 4.46).

2. <u>Relationship Meta-data</u>

When the authorized user indicates that he desires to add, modify, or delete meta-data associated with the entity-type schema, the system presents a panel requesting that the user choose which entity he desires to maintain (Figure 4.47).

a. Adding, Modifying or Deleting Relationship

After the user has identified which relationship-type is to



```
****************************************************************************
*                                                                          *
*                                                                          *
*  C:USER.dbf                                                              *
*                                                  Bytes remaining   3760  *
*                                                  Fields defined      10  *
*                                                                          *
*       Field name Type       Width  Dec                                   *
*                                                                          *
*   1   USER       Logical       1                                         *
*   2   ACC_NAME   Character    10                                         *
*   3   ID_NAME    Character    20                                         *
*   4   DESCRIPT   Character   100                                         *
*   5   DATE_ADDED Date          8                                         *
*   6   ADDED_BY   Character    20                                         *
*   7   COMMENTS   Character    50                                         *
*   8   LST_MOD_DT Date          8                                         *
*   9   LST_MOD_BY Character    20                                         *
*  10   NUM_OF_MOD Numeric       3                                         *
*                                                                          *
*                                                                          *
*                                                                          *
*  Names start with letter; the remainder may be letters, digits or        *
*  underscore                                                              *
*  DEPRESS F1 FOR INSTRUCTIONS                                             *
****************************************************************************
```

Figure 4.46 Entity Schema Maintenance Panel

maintained, the system retrieves the schema structure, displays it, and allows the authorized user to perform the desired maintenance (Figure 4.48).

I. FINAL COMMENTS

Although this prototype IRDS does not possess all of the features that were described in Chapter 3, it does demonstrate that a relational DBMS-dependent implementaion of the NBS IRDS is feasible as demonstrated by the prototype. The extensibility feature described in the standard

```
**********************************************************************
*                                                                    *
* 1.4.2.0.0.0                                                        *
*               INFORMATION RESOURCE DICTIONARY SYSTEM               *
*                                                                    *
*              ADD, MODIFY OR DELETE RELATIONSHIP SCHEMA             *
*                                                                    *
*   1)  USER CONTAINS SYSTEM          8)  FILE CONTAINS RECORDS      *
*                                                                    *
*   2)  SYSTEM CONTAINS PROGRAM       9)  RECORD CONTAINS ELEMENT    *
*                                                                    *
*   3)  PROGRAM PROCESSES FILE       10)  USER RESPONSIBLE FOR SYSTEM *
*                                                                    *
*   4)  PROGRAM PROCESSES RECORD     11)  USER RESPONSIBLE FOR FILE  *
*                                                                    *
*   5)  PROGRAM PROCESSES ELEMENT    12)  PROGRAM PRODUCES DOCUMENT  *
*                                                                    *
*   6)  SYSTEM CONTAINS PROGRAM      13)  RETURN TO PREVIOUS MENU    *
*                                                                    *
*   7)  PROGRAM CONTAINS MODULE      14)  RETURN TO MAIN MENU        *
*                                                                    *
*   ENTER YOUR CHOICE (1-14) FROM ABOVE:                             *
*                                                                    *
*                                                                    *
*                                                                    *
*                                                                    *
**********************************************************************
```

Figure 4.47 Relationship Selection Panel

```
**********************************************************************
*                                                                    *
*                                                                    *
*  C:USER.dbf                                                        *
*                                              Bytes remaining  3760 *
*                                              Fields defined     10 *
*                                                                    *
*      Field name Type       Width  Dec                              *
*                                                                    *
*   1  U_NAME     Character    10                                    *
*   2  S_NAME     Character    10                                    *
*                                                                    *
*                                                                    *
*                                                                    *
*                                                                    *
*                                                                    *
*                                                                    *
*  Names start with letter; the remainder may be letters, digits or  *
*  underscore                                                        *
*  DEPRESS F1 FOR INSTRUCTIONS                                       *
**********************************************************************
```

Figure 4.48 Relationship Schema Maintenance Panel

is enhanced because of the inherent flexibility of the relational environment. Finally the NBS standards provide a firm foundation from which to consider dictionary system implementation.

V. CONCLUSION

This thesis has discussed and evaluated the value of data as a corporate asset and how Data Base Management Systems (DBMS) can be used to manipulate this corporate asset. It has described how the concern over corporate data has led to the development and increased use of Relational Data Bases and in particular Data Dictionaries (DD). Desirable DBMS and DD characteristics, capabilities and features were identified and discussed. Two existing relational DBMS were evaluated concerning the data dictionary features they provided. The result of that evaluation was that relational systems lack a majority of those dictionary features deemed necessary and desirable. Further, all existing DD products were developed.

This thesis then presented, described and discussed the National Bureau of Standards (NBS) Information Resource Dictionary System (IRDS) standard. The standard provides a synthesis of baseline features, capabilities and functions found in existing DD systems plus the additional capabilities of being able to handle all three major types of data base organization: hierarchical, network and relational. Of equal significance, it offers the flexibility for user to expand the dictionary schema to accomodate unique requirements.

This thesis developed a relational model of the NBS IRDS which was implemented as a prototype using a personal computer and dBase III. The prototype demonstrates that the features presented as part of the NBS IRDS are implementable and usable in a relational environment.

It is recommended that the IRDS prototype undergo additional development with the goal of implementing an operational production version of the NBS IRDS standard.

APPENDIX A
CORE STANDARD SCHEMA

This appendix describes the Core System-Standard Schema and its structural characteristics. The Core System-Standard Schema is defined as that specific set of entity-types, relations-types, attribute-types, and other schema descriptors supported by the Core Standard IRDS. While this Core System-Standard Schema satisfies the requirements of many IRDS environments, an organization can customize its IRDS Schema using the Schema Extensibility Facility discussed in previous chapters.

A.1 ATTRIBUTE-TYPES AND ENTITY-TYPES

In this section, the attribute-types and attribute-group-types associated with each entity-type are given. The following are the entity-types in the Core System-Standard Schema:

* USER
* SYSTEM
* PROGRAM
* MODULE
* FILE
* DOCUMENT
* RECORD
* ELEMENT
* BIT-STRING
* CHARACTER-STRING
* FIXED-POINT
* FLOAT

The other entity-types found in the Core System-Standard Schema are:

* DICTIONARY-USER, in support of the Security Facility.
* VIEW which supports the Secutity and View Facilities.

The following two tables present the attributes-types and attribute-group-types accociated with the non-secutiry related entity-types listed above. Attribute-group-types can be identified by the existence of their component attribute-types, which are indented and immediatedly follow the attribute-group-type name. At the intersection of a row and column, the following denote that an entity of the given type:

S   Can have no more than a single attribute of the given type.

P   Can have multiple attributes of the given type.

The first table shows the attribute-types accociated with the following entity-types:

* USER (USR)
* SYSTEM (SYS)
* PROGRAM (PGM)
* MODULE (MDL)
* FILE (FIL)
* DOCUMNET (DOC)
* RECORD (REC)
* ELEMENT (ELE)

(ATTRIBUTE-GROUP-TYPE) AND ATTRIBUTE-TYPE	ENTITY-TYPE							
	USR	SYS	PGM	MDL	FIL	DOC	REC	ELE
ADDED-BY	S	S	S	S	S	S	S	S
(ALLOWABLE-RANGE) LOW-OF-RANGE HIGH-OF-RANGE								P
ALLOWABLE-VALUE								P
CLASSIFICATION	P	P	P	P	P	P	P	P
CODE-LIST-LOCATION								P
COMMENTS	S	S	S	S	S	S	S	S
DATA-CLASS								S
DATE-ADDED	S	S	S	S	S	S	S	S
DESCRIPTION	S	S	S	S	S	S	S	S
DOCUMENT-CATEGORY						S		
(DURATION) DURATION-VALUE DURATION-TYPE		S	S	S				
(IDENTIFICATION-NAME) ALTERNATE-NAME ALTERNATE-NAME-CONTEXT	P	P	P	P	P	P	P	P
LAST-MODIFICATION-DATE	S	S	S	S	S	S	S	S
LAST-MODIFIED-BY	S	S	S	S	S	S	S	S

LOCATION	P	P	P	P	P	P		
NUMBER-OF-LINES-OF-CODE			S	S				
NUMBER-OF-MODIFICATIONS	S	S	S	S	S	S	S	S
NUMBER-OF-RECORDS					S			
RECORD-CATEGORY							S	
SECURITY	S	S	S	S	S	S	S	S
SYSTEM		S						

A.2 RELATIONSHIP-CLASS-TYPES AND RTELATONSHIP-TYPES

This section presents the relationship-class-types and relationship-types in the Core System-Standard Schema. The relationship-class-types, where they exist, are provided in bold print as headers to the relationship-types to which they apply. The inverse-name (which alows the specification of the member entity-tyupes in reverse order) and abbreviated inverse-name are given for each relationship-class-type, so the inverse-name and abbreviared inverse-name for each relationship-type may be inferred. Where no relationship-class-type applies to a particular relationship-type, its inverse-name and abbreviated inverse-name are given directly.

(ATTRIBUTE-GROUP-TYPE) AND ATTRIBUTE÷TYPE	ABBREVIATON	INVERSE-NAME	ABBREVIATED INVERSE-NAME
CONTAINS	CON	CONTAINED-IN	CON-IN
SYSTEM-CONTAINS-SYSTEM	SYS-CON-SYS		
SYSTEM-CONTAINS-PROGRAM	SYS-CON-PGM		
SYSTEM-CONTAINS-MODULE	SYS-CON-MDL		
PROGRAM-CONTAINS-PROGRAM	PGM-CON-PGM		
PROGRAM-CONTAINS-MODULE	PGM-CON-MDL		
MODULE-CONTAINS-MODULE	MDL-CON-MDL		
FILE-CONTAINS-FILE	FIL-CON-FIL		
FILE-CONTAINS-DOCUMENT	FIL-CON-DOC		
FILE-CONTAINS-RECORD	FIL-CON-REC		
FILE-CONTAINS-ELEMENT	FIL-CON-ELE		
DOCUMENT-CONTAINS-DOCUMENT	DOC-CON-DOC		
DOCUMENT-CONTAINS-RECORD	DOC-CON-REC		
DOCUMENT-CONTAINS-ELEMENT	DOC-CON-ELE		
RECORD-CONTAINS-RECORD	REC-CON-REC		
RECORD-CONTAINS-ELEMENT	REC-CON-ELE		

ELEMENT-CONTAINS-ELEMENT	ELE-CON-ELE		
PROCESSES	PR	PROCESSED-BY	PR-BY
USER-PROCESSES-FILE	USREC-PR-FILIL		
USER-PROCESSES-DOCUMENT	USR-PR-DOC		
USER-PROCESSES-RECORD	USR-PR-REC		
USER-PROCESSES-ELEMENT	USR-PR-ELE		
SYSTEM-PROCESSES-FILE	SYS-PR-FIL		
SYSTEM-PROCESSES-DOCUMENT	SYS-PR-DOC		
SYSTEM-PROCESSES-RECORD	SYS-PR-REC		
SYSTEM-PROCESSES-ELEMENT	SYS-PR-ELE		
PROGRAM-PROCESSES-FILE	PGM-PR-FIL		
PROGRAM-PROCESSES-DOCUMENT	PGM-PR-DOC		
PROGRAM-PROCESSES-RECORD	PGM-PR-REC		
PROGRAM-PROCESSES-ELEMENT	PGM-PR-ELE		
MODULE-PROCESSES-FILE	MDL-PR-FIL		
MODULE-PROCESSES-DOCUMENT	MDL-PR-DOC		
MODULE-PROCESSES-RECORD	MDL-PR-REC		
MODULE-PROCESSES-ELEMENT	MDL-PR-ELE		
RESPONSIBLE-FOR	R-FOR	RESPONSIBILITY-OF	R-OF
USER-RESPONSIBILE-FOR-SYSTEM	USR-R-FOR-SYS		
USER-RESPONSIBLE-FOR-PROGRAM	USR-R-FOR-PGM		
USER-RESPONSIBLE-FOR-MODULE	USR-R-FOR-MDL		
USER-RESPONSIBLE-FOR-RECORD	USR-R-FOR-REC		
USER-RESPONSIBLE-FOR-DOCUMENT	USR-R-FOR-DOC		
USER-RESPONSIBLE-FOR-RECORD	USR-R-FOR-REC		
USER-RESPONSIBLE-FOR-ELEMENT	USR-R-FOR-ELE		
RUNS	RUNS	RUN-BY	RUN-BY
USER-RUNS-SYSTEM	USR-RUN-SYS		
USER-RUNS-PROGRAM	USR-RUN-PGM		
USER-RUNS-MODULE	USR-RUNS-MDL		
GOES-TO	TO	COMES-FROM	FR
SYSTEM-GOES-TO-SYSTEM	SYS-TO-SYS		
PROGRAM-GOES-TO-PROGRAM	PGM-TO-PGM		
MODULE-GOES-TO-MODULE	MDL-TO-MDL		
DERIVED-FROM	D-FR	PRODUCES	PRD
DOCUMENT-DERIVED-FROM-FILE	DOC-D-FR-FIL		
DOCUMENT-DERIVED-FROM-DOCUMENT	DOC-D-FR-DOC		
DOCUMENT-DERIVED-FROM-RECORD	DOC-D-FR-REC		
ELEMENT-DERIVED-FROM-FILE	ELE-D-FR-FIL		
ELEMENT-DERIVED-FROM-DOCUMENT	ELE-D-FR-DOC		
ELEMENT-DERIVED-FROM-RECORD	ELE-D-FR-REC		
ELEMENT-DERIVED-FROM-ELEMENT	ELE-D-FR-ELE		
FILE-DERIVED-FROM-DOCUMENT	FIL-D-FR-DOC		
FILE-DERIVED-FROM-FILE	FIL-D-FR-FIL		
RECORD-DERIVED-FROM-DOCUMENT	REC-D-FR-DOC		
RECORD-DERIVED-FROM-FILE	REC-D-FR-FIL		

RECORD-DERIVED-FROM-RECORD	REC-D-FR-REC		
CALLS	CLS	CALLED-BY	CLD-BY
PROGRAM-CALLS-PROGRAM	PGM-CLS-PGM		
PROGRAM-CALLS-MODULE	PGM-CLS-MDL		
MODULE-CALLS-MODULE	MDL-CLS-MDL		
REPRESENTED-AS	AS	REPRESENTS	REP
ELEMENT-REPRESENTED-AS -BIT-STRING	ELE-AS-BIT		
ELEMENT-REPRESENTED-AS -CHARACTER-STRING	ELE-AS-CHR		
ELEMENT-REPRESENTED-AS -FIXED-POINT	ELE-AS-FIX		
ELEMENT-REPRESENTED-AS -FLOAT	ELE-AS-FLO		
ELEMENT-STANDARD-FOR-ELEMENT	ELE-ST-FOR-ELE		
(Inverse is: ELEMENT-STANDARD-OF-ELEMENT	ELE-ST-OF-ELE)		
FILE-HAS-SORT-KEY-ELEMENT	FIL-H-S-K-ELE		
(Inverse is: ELEMENT-SORT-KEY-OF-FILE	ELE-S-K-OF-FIL)		
FILE-HAS-ACCESS-KEY-ELEMENT	FIL-H-A-K-ELE		
(Inverse is: ELEMENT-ACCESS-KEY-OF-FILE	ELE-A-K-OF-FIL)		

A.3 ENTITY-TYPES AND RELATIONSHIP-TYPES

The following two tables depict the entity-types particulating as members of the non-security related relationship-types in the Core System-Standard Schema. The following notation in to denote that the entity-type is:

1 The first member of the relationship-type.

2 The second member of the relationship-type.

R Both the first and second member of the relationship-type

The first table shows the relationship-types associated with the following entity-types:

* USER
* SYSTEM
* PROGRAM
* MODULE
* FILE
* DOCUMENT
* RECORD
* ELEMENT

RELATIONSHIP-CLASS-TYPE AND RELATIONSHIP-TYPE	USR	SYS	PGM	MDL	FIL	DOC	REC	ELE
CONTAINS								
SYSTEM-CONTAINS-SYSTEM	.	R	.	.	.	.	.	.
SYSTEM-CONTAINS-PROGRAM	.	1	2	.	.	.	.	.
SYSTEM-CONTAINS-MODULE	.	1	.	2	.	.	.	.
PROGRAM-CONTAINS-PROGRAM	.	.	R	.	.	.	.	.
PROGRAM-CONTAINS-MODULE	.	.	1	2	.	.	.	.
MODULE-CONTAINS-MODULE	.	.	.	R	.	.	.	.
FILE-CONTAINS-FILE	.	.	.	.	R	.	.	.
FILE-CONTAINS-DOCUMENT	.	.	.	.	1	2	.	.
FILE-CONTAINS-RECORD	.	.	.	.	1	.	2	.
FILE-CONTAINS-ELEMENT	.	.	.	.	1	.	.	2
DOCUMENT-CONTAINS-DOCUMENT	.	.	.	.	.	R	.	.
DOCUMENT-CONTAINS-RECORD	.	.	.	.	.	1	2	.
DOCUMENT-CONTAINS-ELEMENT	.	.	.	.	.	1	.	2
RECORD-CONTAINS-RECORD	.	.	.	.	.	.	R	.
RECORD-CONTAINS-ELEMENT	.	.	.	.	.	.	1	2
ELEMENT-CONTAINS-ELEMENT	.	.	.	.	.	.	.	R
PROCESSES								
USER-PROCESSES-FILE	1	.	.	.	2	.	.	.
USER-PROCESSES-DOCUMENT	1	.	.	.	.	2	.	.
USER-PROCESSES-RECORD	1	.	.	.	.	.	2	.
USER-PROCESSES-ELEMENT	1	.	.	.	.	.	.	2
SYSTEM-PROCESSES-FILE	.	1	.	.	2	.	.	.
SYSTEM-PROCESSES-DOCUMENT	.	1	.	.	.	2	.	.
SYSTEM-PROCESSES-RECORD	.	1	.	.	.	.	2	.
SYSTEM-PROCESSES-ELEMENT	.	1	.	.	.	.	.	2
PROGRAM-PROCESSES-FILE	.	.	1	.	2	.	.	.
PROGRAM-PROCESSES-DOCUMENT	.	.	1	.	.	2	.	.
MODULE-PROCESSES-RECORD	.	.	1	.	.	.	2	.
PROGRAM-PROCESSES-ELEMENT	.	.	1	.	.	.	.	2
MODULE-PROCESSES-FILE	.	.	.	1	2	.	.	2
MODULE-PROCESSES-DOCUMENT	.	.	.	1	.	2	.	.
MODULE-PROCESSES-RECORD	.	.	.	1	.	.	2	.
MODULE-PROCESSES-ELEMENT	.	.	.	1	.	.	.	2
RESPONSIBLE-FOR								
USER-RESPONSIBILE-FOR-SYSTEM	1	2	.	.	.	.	.	.
USER-RESPONSIBLE-FOR-PROGRAM	1	.	2	.	.	.	.	.
USER-RESPONSIBLE-FOR-MODULE	1	.	.	2	.	.	.	.
USER-RESPONSIBLE-FOR-RECORD	1	.	.	.	2	.	.	.
USER-RESPONSIBLE-FOR-DOCUMENT	1	.	.	.	.	2	.	.
USER-RESPONSIBLE-FOR-RECORD	1	.	.	.	.	.	2	.
USER-RESPONSIBLE-FOR-ELEMENT	1	.	.	.	.	.	.	2

RUNS								
USER-RUNS-SYSTEM	1	2	.	.	.	.	.	.
USER-RUNS-PROGRAM	1	.	2	.	.	.	.	.
USER-RUNS-MODULE	1	.	.	2	.	.	.	.
GOES-TO								
SYSTEM-GOES-TO-SYSTEM	.	R	.	.	.	.	.	.
PROGRAM-GOES-TO-PROGRAM	.	.	R	.	.	.	.	.
MODULE-GOES-TO-MODULE	.	.	.	R	.	.	.	.
DERIVED-FROM								
DOCUMENT-DERIVED-FROM-FILE	.	.	.	.	R	.	.	.
DOCUMENT-DERIVED-FROM-DOCUMENT	.	.	.	.	1	2	.	.
DOCUMENT-DERIVED-FROM-RECORD	.	.	.	.	2	1	.	.
ELEMENT-DERIVED-FROM-FILE	.	.	.	.	.	R	.	.
ELEMENT-DERIVED-FROM-DOCUMENT	.	.	.	.	.	1	2	.
ELEMENT-DERIVED-FROM-RECORD	.	.	.	.	.	2	1	.
ELEMENT-DERIVED-FROM-ELEMENT	.	.	.	.	2	.	1	.
FILE-DERIVED-FROM-DOCUMENT	.	.	.	.	.	.	R	.
FILE-DERIVED-FROM-FILE	.	.	.	.	2	.	.	1
RECORD-DERIVED-FROM-DOCUMENT	.	.	.	.	.	2	.	1
RECORD-DERIVED-FROM-FILE	.	.	.	.	.	.	2	1
RECORD-DERIVED-FROM-RECORD	.	.	.	.	.	.	.	R
CALLS								
PROGRAM-CALLS-PROGRAM	.	.	R	.	.	.	.	.
PROGRAM-CALLS-MODULE	.	.	1	2	.	.	.	.
MODULE-CALLS-MODULE	.	.	.	R	.	.	.	.
ELEMENT-STANDARD-FOR-ELEMENT	.	.	.	.	.	.	.	R
FILE-HAS-SORT-KEY-ELEMENT	.	.	.	.	1	.	.	2
FILE-HAS-ACCESS-KEY-ELEMENT	.	.	.	.	1	.	.	2

The last three relationship-types are not members of a relationship-class, and so are listed separetl.

The second table shows the relationship-types associated with the following entity-types:

* ELEMENT
* BIT-STRING
* CHARACTER-STRING
* FIXED-POINT
* FLOAT

RELATIONSHIP-CLASS-TYPE AND RELATIONSHIP-TYPE	ELE	BIT	CHR	FIX	FLO

REPRESENTED-AS					
ELEMENT-REPRESENTED-AS-BIT-STRING	1	2	.	.	.
ELEMENT-REPRESENTED-AS-CHARACTER-STRING	1	.	2	.	.
ELEMENT-REPRESENTED-AS-FIXED-POINT	1	.	.	2	.
ELEMENT-REPRESENTED-AS-FLOAT	1	.	.	.	2

A.4 ATTRIBUTE-TYPES AND RELATIONSHIP-TYPES

The following are the attribute-types assicociated with the relationship-class-types and relationship-types in the Core System-Standard Schema:

* The relationship-types
  - SYSTEM-PROCESSES-FILE
  - PROGRAM-PROCESSES-FILE
  - MODULE-PROCESSES-FILE

  have the single-valued attribute-type ACCESS-METHOD associated with them.

* All PROCESSES and RUNS relationship-types have the single-valued attribute-typw FREQUENCT associated with them.

* The relationship-type RECORDS-CONTAINS-ELEMENT has the single-valued attribute-type RELATIVE-POSITION associated with it.

* The relationship-type ELEMENT-REPRESENTED-AS-BIT-STRING has the single-valued attribute-type LENGTH and the multiple-valued attribute-type USAGE associated the it.

* The relationship-type ELEMENT-REPRESENTED-AS-CHARACTER-STRING has the single-valued attribute-types LENGTH and JUSTIFICATION and the multiple-valued attribute-type USAGE associated with it.

* The relationship-types
  - ELEMENT-REPRESENTED-AS-FIXED-POINT
  - ELEMENT-REPRESENTED-AS-FLOAT

  have the single-valued attribute-types LENGTH, PRECISION, and SCALE, and the multiple-valued attribute-type USAGE associated with them.

A.5 SUPPORT FOR THE CORE SECURITY FACILITY

In addition to the entity-types DICTIONARY-USER and VIEW the Core System-Standard Schema also contains the relationship-type DICTIONARY-USER-HAS-VIEW, which assiciates a IRDS user with the views he/she may use. A number of attributes-types and attribute-group-types in the Core System-Standard schema are used to specify the categories of permissions that can be assigned to a IRDS user with a particular view.

A.6 THE ATTRIBUTE-TYPE-VALIDATION-PROCEDURE META ENTITIES

The Core System-Standard Schema contains the following two attribute-type-validation-procedure meta-entities:

* RANGE-VALIDATION, used to restrict the attributes of a given attribute-type to a predefined set of ranges.

* VALUE-VALIDATION, used to restrict the attributes of a given attribute-type to a predefined set of values.

A.7 THE ATTRIBUTE-TYPE-VALIDATION-DATA META-ENTITIES

There are no attribute-type-validation-data meta-entities specified in the Core System-Standard Schema. To use this feature, an organization must define and add these meta-entities to the schema.

A.8 THE LIFE-CYCLE-PHASE META-ENTITIES

The Core System-Standard Schema contains four Life-Cycle-Phase meta-entities. These are:

* UNCONTROLLED-PHASE - Entities are in this life-cycle-phase when they are added to the IRD.
* CONTROLLED-PHASE - Entities used in an operational environment, for which structural integrity controls are provided by the IRDS, are in this life-cycle-phase.
* ARCHIVED-PHASE - This life-cycle-phase is used to document those entities no longer in use.
* SECURITY-PHASE - This life-cycle-phase, of phase class UNCONTROLLED is used for DICTIONARY-USER entities associated with the Security Facility of the Core Standard IRDS.

A.9 THE QUALITY-INDICATOR META-INTITIES

The Core System-Standard Schema does not contain any pre-defined QUALITY-INDICATOR meta-entities. These meta-entities may be defined by an organization.

A.10 THE VARIATION-NAMES META-ENTITIES

There are also no pre-defined VARIATION-NAMES meta-entities in the Core System-Standard Schema. These meta-entities may be defined by an organization.

A.11 THE SCHEMA-DEFAULTS META-ENTITIES

There is one SCHEMA-DEFAULTS meta-entity in the Core System-Standard Schema. This meta-entity, called EXISTING-SCHEMA-DEFAULTS, is used to establish minimum and maximum name lengths and minimum and maximum attribute lengths in IRD.

APPENDIX B
COMMAND SPECIFICATIONS

SYNTAX:
All words shown in captials are required.
[] = Optional
<> = user supplied
{} = May be repeated as required

1. Schema Commands

1.1 Schema Maintenance

* Add Meta-Entity Command

```
ADD META-ENTITY <Meta-entity-name>
  META-ENTITY-TYPE = <Meta-entity-type>
    WITH META-ATTRIBUTES
      [{<Meta-attribute-name> = <Initial value>}];
```

* Modify Meta-Entity Command

```
MODIFY META-ENTITY <Meta-entity-name>
  WITH META-ATTRIBUTES
    {<Meta-attribute-name> = <new value>};
```

* Delete Meta-Entity Command

```
DELETE META-ENTITY <Meta-entity-name>;
```

* Add Meta-Relationship Command

```
ADD META-RELATIONSHIP
  FROM <Meta-entity-name-1> TO <Meta-entity-name-2>
  WITH META-ATTRIBUTES
    [{<Meta-attribute-name> = <value>}];
```

* Modify Meta-Relationship Command

```
MODIFY META-RELATIONSHIP
  FROM <Meta-entity-name-1> TO <Meta-entity-name-2>
  WITH META-ATTRIBUTES
    {<Meta-attribute-name> = <value>}
    [<Meta-entity-name-1> = <Meta-entity-name>]
    [<Meta-entity-name-2> = <Meta-entity-name>]
    [{<Meta-attribute-name> = <New-value>}];
```

* Delete Meta-Relationship Command

```
DELETE META-RELATIONSHIP
  FROM <Meta-entity-name-1> TO <Meta-entity-name-2>
  WITH META-ATTRIBUTES
    [{<Meta-attribute-name> = <value>}];
```

* Replace Meta-Relationship Command

```
REPLACE META-RELATIONSHIP
  FROM <Meta-entity-name-1> TO <Meta-entity-name-2>
  WITH META-ATTRIBUTES
    [{<Meta-attribute-name-1> = <value>}]
  BY FROM <Meta-entity-name-1> TO <Meta-entity-name-3>
  WITH META-ATTRIBUTES
    [{<Meta-attribute-name-2> = <value>}];
```

* Modify Meta-Entity Name Command

```
MODIFY META-ENTITY-NAME
  FROM <Meta-entity-name-1> TO <Meta-entity-name-2>:
```

* Install Meta-Entity Command

```
INSTALL <Meta-entity-name>;
```

1.2 Schema Output Command

```
*  OUTPUT SCHEMA
     SELECT [ALL] or [<meta-entity-name-list>]
       [WHERE <restriction-expression> boolean operator
<restriction-expression>]
         [<Title>]
           [ SHOW ALL] or
           [ SHOW ALL META-ATTRIBUTES or
             <Meta-attribute-list>] and/or
           [ SHOW ALL META-RELATIONSHIPS or
             <Meta-relationships-list>] and/or
         [ROUTE TO <Destination-list>];
```

2. Dictionary Commands

2.1 Dictionary Maintenance Commands

* Add Entity Command

```
ADD ENTITY <entity-name>
  ENTITY-TYPE = <entity-type>
    WITH ATTRIBUTES
      [{<attribute-name> = <Initial value>}];
```

* Modify Entity Command

```
MODIFY ENTITY <entity-name>
  [{<attribute-name> = <New value>}];
```

* Delete Entity Command

```
DELETE ENTITY
  [<Entity-name>] or
    [USING = <Entity-list-name>] or
    [USING PROCEDURE = <Procedure-name>] or
    [SELECT WHERE <restriction-expression> boolean
                  operator <restriction-expression>];
```

* Add Relationship Command

```
ADD RELATIONSHIP
  <Entity-name-1> <Relationship-type> <Entity-name-2>
    WITH ATTRIBUTES
      [{<attribute-name> = <Initial value>}];
```

* Modify Relationship Command

```
MODIFY RELATIONSHIP
  <Entity-name-1> <Relationship-type> <Entity-name-2>
    [{<attribute-name> = <New value>}];
```

* Delete Relationship Command

```
MODIFY RELATIONSHIP
  [<Entity-name-1> <Relationship-type> <Entity-name-2>]
  [<Relationship-list-name>];
```

* Modify Access-Name Command

```
MODIFY ACCESS-NAME
  <Current access-name> TO <New access-name>;
```

* Modify Descriptive-Name Command

```
MODIFY DESCRIPTIVE-NAME
  <Current descriptive-name> TO <New descriptive-name>;
```

* Modify Entity Life-Cycle-Phase Command

```
MODIFY ENTITY LIFE-CYCLE-PHASE
  FOR <Entity-name> or <Entity-list-name>
  FROM <Current life-cycle-phase> TO <New life-cycle-
        phase>;
```

* Copy Entity Command

```
COPY ENTITY <Entity-name>
  [WITH RELATIONSHIPS]
    TO <New entity-name>
      [DESCRIPTIVE-NAME = <Descriptive-name>]
```

```
                    [QUALITY = <Quality-indicator>];
```

2.2 Dictionary Output Commands

* General Output Command

```
        OUTPUT DICTIONARY
          [USING VIEW = ALL]
          [USING VIEW = <view-name> or <view-name-list>]
          SELECT [ALL] or
            [ENTITIES]
              <restriction-expression>
              <boolean operator>
              <restriction-expression>
            [SORT SEQUENCE = <sort-parm-list>]
          SHOW <show-options>
            [SHOW <Title>
            [ROUTE TO <destination-list>]
            [PROCEDURE-NAME = <procedure-name>;
```

* Output Impact-of-Change Command

```
        OUTPUT IMPACT
          [USING VIEW = ALL]
          [USING VIEW = <view-name> or <view-name-list>]
          SELECT [ALL] or
            [ENTITIES]
              <restriction-expression>
              <boolean operator>
              <restriction-expression>
            [SORT SEQUENCE = <sort-parm-list>]
          SHOW <show-options>
            [SHOW <Title>
            [SHOW LIFE-CYCLE-PHASE]
            [SHOW QUALITY-INDICATOR]
            [SHOW ATTRIBUTES [ALL] or [NO] or
              [<attribute-name>]]
            [SHOW DESCRIPTIVE-NAME]
          [ROUTE TO <destination-list>]
          [PROCEDURE-NAME = <procedure-name>];
```

* Output Syntax Commands

```
        OUTPUT SYNTAX
          [USING VIEW = ALL]
          [USING VIEW = <view-name> or <view-name-list>]
          SELECT [ALL] or
            [ENTITIES]
              <restriction-expression>
              <boolean operator>
              <restriction-expression>
            [SORT SEQUENCE = <sort-parm-list>]
```

```
SHOW <show-options>
  [SHOW <Title>]
  [SHOW LIFE-CYCLE-PHASE]
  [SHOW QUALITY-INDICATOR]
  [SHOW RELATIONSHIP <relationship-display-options>]
  [SHOW RELATIONSHIP SYNTAX FOR EACH <entity-name>]
[ROUTE TO <destination-list>]
[PROCEDURE-NAME = <procedure-name>];
```

2.3 Dictionary Entity-List Commands

* Build Entity-List Command

```
BUILD ENTITY-LIST
  SELECT [ALL] or
    [ENTITIES]
      <restriction-expression>
      <boolean operator>
      <restriction-expression>
  [LIST-NAME = <entity-list-name>]
  [USING VIEW = ALL]
  [USING VIEW = <view-name> or <view-name-list>]
  [PROCEDURE-NAME = <procedure-name>]
  [PROCEDURE-DESCRIPTION = <short-string-literal>];
```

* Entity-List Union Command

```
UNION
  <existing entity-list-name>,
  {<existing entity-list-name>}
  = <new entity-list-name>;
```

* Entity-List Intersection Command

```
INTERSECTION
  <existing entity-list-name>,
  {<existing entity-list-name>}
  = <new entity-list-name>;
```

* Entity-List Difference Command

```
DIFFERENCE
  <entity-list-1-name>,<entity-list-2-name>
  = <new entity-list-name>;
```

* Entity-List Subtraction Command

```
SUBTRACTION
  <entity-list-1-name>,<entity-list-2-name>
  = <new entity-list-name>;
```

* Name Current Entity-List Command

```
NAME CURRENT ENTITY-LIST <entity-list-name>;
```

* Output Entity-List Command

```
OUTPUT ENTITY-LIST
  [LIST-NAME = <entity-list-name>]
  [SHOW <Title>]
  [ROUTE TO <destination-list>];
```

* Output Entity-List Names Command

```
OUTPUT ENTITY-LIST NAME
  [SHOW <Title>]
  [ROUTE TO <destination-list>];
```

2.4 Dictionary Procedure Commands

* Output Procedure Syntax command

```
OUTPUT PROCEDURE SYNTAX
  ALL or <procedure-name>
  [SHOW <Title>]
  [ROUTE TO <destination-list>];
```

* Output Procedure Names Command

```
OUTPUT PROCEDURE-NAME
  [SHOW PROCEDURE-DESCRIPTION]
  [ROUTE TO <destination-list>];
```

* Run Output Procedure Command

```
RUN OUTPUT PROCEDURE <procedure-name>
  [USING VIEW = ALL]
  [USING VIEW = <view-name> or <view-name-list>]
  [ROUTE TO <destination-list>];
```

* Run Entity-List Procedure Command

```
RUN ENTITY-LIST PROCEDURE <procedure-name>
  [LIST-NAME = <entity-list-name>]
  [USING VIEW = ALL]
  [USING VIEW = <view-name> or <view-name-list>];
```

* Save Output Procedure Command

```
SAVE OUTPUT PROCEDURE
  PROCEDURE-NAME = <procedure-name>
  [PROCEDURE-DESCRIPTION = <short-string-literal>];
```

* Save Entity-List Procedure Command

```
SAVE ENTITY-LIST PROCEDURE
  PROCEDURE-NAME = <procedure-name>
  [PROCEDURE-DESCRIPTION = <short-string-literal>];
```

* Delete Procedure Command

```
DELETE <procedure-type> PROCEDURE <procedure-name>;
```

3. General Commands

3.1 IRD-IRD Interface Commands

* Create Dictionary Command

```
CREATE DICTIONARY <new-dictionary-name>
  [LOCATION CLAUSE <implementor-defined>]
  SCHEMA IS
    [IN DICTIONARY <dictionary-name> ]
    [IN FILE <file-name>]
    [STANDARD]
  [LOAD DICTIONARY FROM <file-name>];
```

* Export Dictionary Command

```
EXPORT DICTIONARY
  [USING VIEW = ALL]
  [USING VIEW = <view-name> or <view-name-list>]
  [USING ENTITY-LIST= <Entity-list-name>]
  [EXCLUDE RELATIONSHIP OF [<relationship-type>] or
    [<relationship-list-name>]]
  [SCHEMA EXPORT FILE = <export-file-name>]
  [SYNTAX = <short-string-literal>];
```

* Check Schema Compatibility Command

```
CHECK SCHEMA
  [SOURCE] or [TARGET] SCHEMA IS
    [IN DICTIONARY <dictionary-name> ]
    [IN FILE <file-name>]
    [STANDARD];
```

* import Dictionary Command

```
IMPORT DICTIONARY
  SCHEMA EXPORT FILE = <export-file-name>
  DICTIONARY EXPORT FILE =
    <dictionary-export-file-name>
    [IN DICTIONARY <dictionary-name>]
    [IN FILE <file-name>]
```

```
          [STANDARD]
        LIFE-CYCLE-PHASE = <life-cycle-phase-name>;
```

3.2 Utility Commands

* Set Session Default Command

```
SET
  [VIEW = <view-name>]
  [MODE = <mode-type>]
  [SHOW ATTRIBUTES
    [ENCODED or DECODED]]
  [{<implementor-defined-options>}]
  [SAVE];
```

* Session Status Command

```
STATUS
  [ALL]
  [DICTIONARY]
    [ENTITY-LIST]
    [MODE]
    [VIEWS]
    [PROFILES]
    [DEFAULTS]
    [<implementor-defined-options>];
```

* Help Command

```
HELP
  [ALL]
  [<command-imperative-substring>];
```

* Exit Dictionary System Command

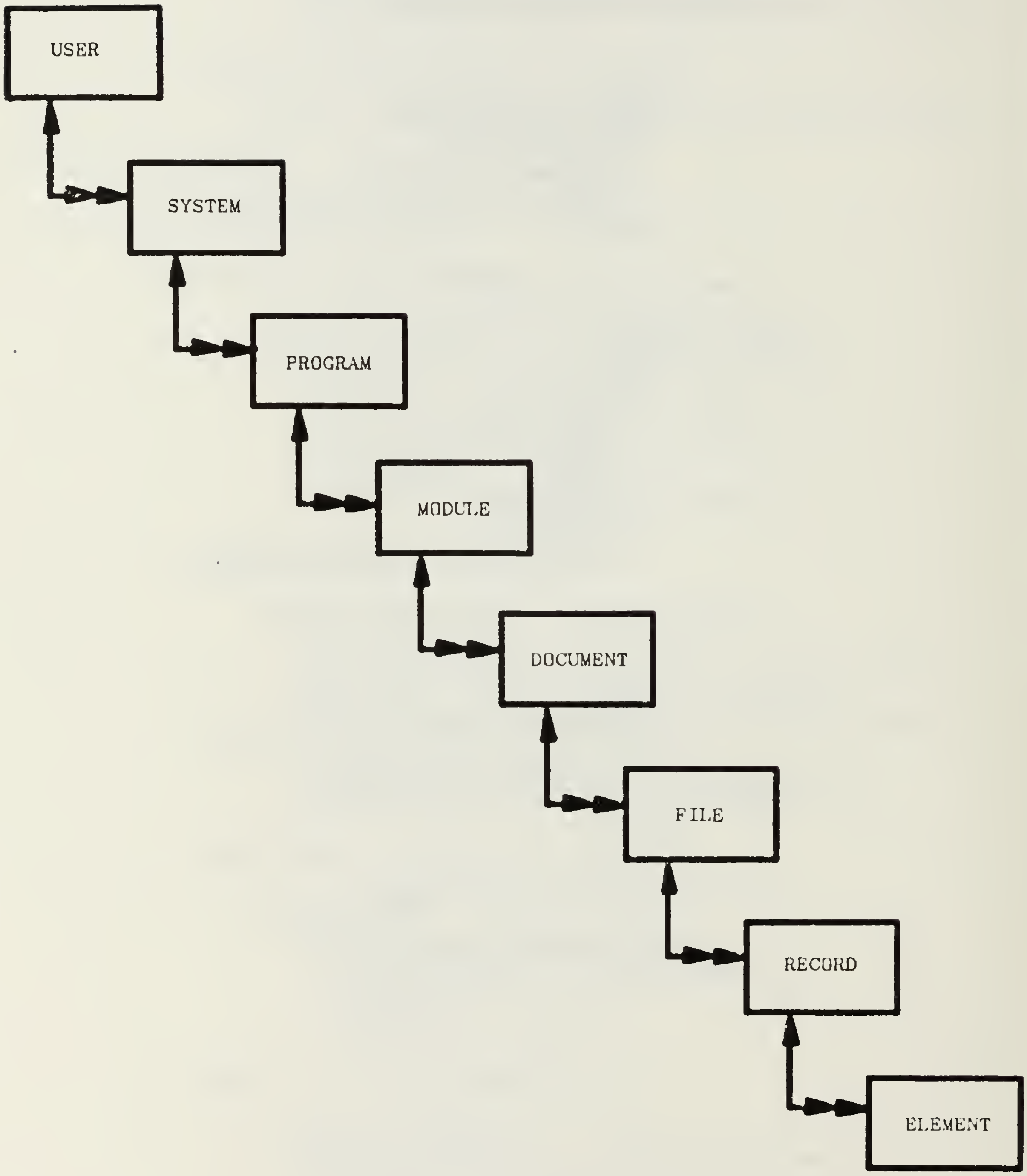
```
EXIT;
```

* Enter Panel Dialogue Command

```
PANEL NAME = <panel-name>;
```

APPENDIX C

BACHMAN DIAGRAMS



APPENDIX D
SUPPORT OF STANDARD DATA MODELS

This appendix describes the new entity-types, relationship-types and attribure-types which can be added to the IRD to allow the system to map into NDL and SQL data structures.[Ref 9, pages 16-20]

D.1 NETWORD MODEL MAPPINGS

The following tables describe the mappings between the generic entity-types of the Core IRD and the Network Model entities and relationships.

Network Data Model Mapping - Entity types

NDL	IRD Generic Model
Schema	Schema
Subscema	Subscema
Database	Database
Record	Record *
Set	Set
Component	Element *
Module	Module *
Database Procedure	Program *
Data Type	Element *

Network Data Model Mappings - relationship-types

NDL	IRD Generic Model ++
Subschema in	Schema-Contains-Schema
Schema is	Schema-Contains-Set
	Schema-Contains-Record
Owner is	Set-Owner-Is-Record
Members are	Set-Member-Is-Record
Contains	Record-Contains-Element
	Element-Contains-Element
Identifier	Set-Has-Sort-Key-Element
	Record-Redefines-Record
	Schema-Defines-Database
	Element-Associated-With-Element

* Note - these are already defined in the Core IRDS Standard.

++ Note - these NDL relationships are in addition to those appearing in the IRDS Specifications in the Core IRDS. A relationship that is in the Core Standard doesnot appear here unless a different NDL relationship maps into it.

D.2 RELATIONAL MODEL MAPPINGS

The following tables shows the mappings between the generic and Relational Model entities and relationships:

Network Data Model Mapping - Entity types	
SQL	IRD Generic Model
Schema	Schema
Table	Record *
Column	Element *
Data Type	Element *
Query & Operations (Join, Projection, etc.)	Set

Relational Data Model Mappings - Relationship-types	
SQL	IRD Generic Model ++
Submodel id tables	Schema-Contains-Schema
	Schema-Contains-Set
is made up of Table	Schema-Contains-Record
identified by	Record-Has-Access-Key-Element
	Element-Identifies-Element
	Element-Identifies-Record
is made up of Columns	Record-Contains-Element
	Element-Associated-With-Element

* Note - these are already defined in the Core IRDS Standard.

++ Note - these SQL relationships are in addition to those appearing in the IRDS Specifications in the Core IRDS. A relationship that is in the Core Standard doesnot appear here unless a different NDL relationship maps into it.

D.3 ENTITY-TYPES AND RELATIONSHIP-TYPES

The following table identify new and existing entity-types and gives their applicability to the SQL and NDL database models:

Applicaability Matrix of Entity-Types

	SCHEMA	DATABASE	RECORD	SET	ELEMENT	MODULE	PROGRAM
New Entity type	Y	Y		Y			
SQL Model	Y	Y	Y	Y	Y		
NDL Model	Y	Y	Y	Y	Y	Y	Y

The following table identifies new and existing relationship-types and gives their applicaability to the SQL and NDL database models:

Applicability Matrix of Relationship-Types

	ECE	RCE	RAE	RRR	SCS	SCT	SOE	SMR	SOR	EIR	SDD	EIE	EAE	SCR
New Relat-ionship -type			Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	Y
NDL Model	Y	Y	Y	Y	Y	Y	Y	Y	Y		Y		Y	Y
SQL Model		Y	Y		Y	Y		Y		Y	Y	Y	Y	Y

DESCRIPTION LEGEND:

ECE	=	Relationship-Type "Element-Contains-Element"
RCE	=	Relationship-Type "Record-Contains-Element"
RAE	=	Relationship-Type "Record-Has-Access-Key-Element"
RRR	=	Relationship-Type "Record-Redefines-Record"
SCS	=	Relationship-Type "Schema-Contains-Schema"
SCT	=	Relationship-Type "Schema-Contains-Set"
SOE	=	Relationship-Type "Set-Has-Sort-Key-Element"
SMR	=	Relationship-Type "Set-Member-Is-Record"
SOR	=	Relationship-Type "Set-Owner-Is-Record"
EIR	=	Relationship-Type "Element-Identifies-Record"
SDD	=	Relationship-Type "Schema-Defines-Database"
EIE	=	Relationship-Type "Element-Identifies-Element"

EAE = Relationship-Type "Element-Associated-With -Element"
SCR = Relationship-Type "Schema-Contains-Record"

D.4 ATTRIBUTE-TYPE ASSOCIATIONS

The following table depicts the association between attribure-types and the entity-types to which they apply. The "common" attribute-types defined as part of the Core Standard IRD apply as well.

Applicability Matrix of Attribute-Types to Entity-Types

Attribute-Type	SCH	DBA	RCD	SET	ELM	MDL	PGM
LANGUAGE	X		X		X		
INITIAL-POPULATION			X				
RATE-OF-ARRIVALS			X				
RATE-OF-DEPARTURES			X				
RATE-OF-ACCESS			X				
RATE-OF-UPDATE			X				
DEFAULT-CLAUSE					X		
USAGE	X	X	X	X	X	X	

DESCRIPTION LEGEND:

SCH = Entity-type "SCHEMA"
DBS = Entity-type "DATABASE"
RCD = Entity-type "RECORD"
SET = Entity-type "SET"
ELM = Entity-type "ELEMENT"
MDL = Entity-type "MODULE"
PGM = Entity-type "PROGRAM"

The following table shows the attribute-types associated with relationship-types:

Applicability Matrix of attribute-types to Relationship-Types

Attribute-Type	SMR	RAE	EAE	SOE	SCS	SCT	SOR	RRR
ACCESS-METHOD		X						
KEY-SELECT		X						
ORDER-CLAUSE	X							
INSERTION-MODE	X							
RETENTION-MODE	X							
ORDER		X		X				
DUPLICATES	X							
OCCURS-CLAUSE			X					
LANGUAGE								X
USAGE					X		X	X

DESCRIPTION LEGEND:

SMR	=	Relationship-type	"SET-MEMBER-IS-RECORD"
RAE	=	Relationship-type	"RECORD-SA-ACCESS-KEY-ELEMENT"
EAE	=	Relationship-type	"ELEMENT-ASSOCIATION-WITH -ELEMENT"
SOE	=	Relationship-type	"SET-HAS-SORT-KEY-ELEMENT"
SCS	=	Relationship-type	"SCHEMA-CONTAINS-SCHEMA"
SCT	=	Relationship-type	"SCHEMA-CONTAINS-SET"
SOR	=	Relationship-type	"SET-OWNER-IS-RECORD"
RRR	=	Relationship-type	"RECORD-REDEFINES-RECORD"

APPENDIX E
IRDS PROTOTYPE SOFTWARE

```
* MAIN.PRG
* MODULE NAME: MAIN
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: NONE
* ROUTINES THAT THE MODULE CALLS:1.1.0.0.0.0, 1.2.0.0.0.0, 1.3.0.0.0.0,
*                                 1.4.0.0.0.0, 1.5.0.0.0.0, 1.6.0.0.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED.
* one-time: USED TO INSURE THAT THE ASSOCIATED ROUTINE IS RUN ONLY ONCE.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
* test     : USED TO ALLOW THE USER TO TEST FOR CAPS LOCK DOWN.
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM STARTS THE INFORMATION RESOURCE DICTIONARY SYSTEM
* IT ALLOW THE USER TO CHOOSE WHICH FUNCTION WITHIN THE SYSTEM
* HE WOULD LIKE TO DO.
*
SET SAFETY OFF
STORE .t. TO one_time
DO WHILE one_time
CLEAR
STORE '      ' TO test
@ 1,1 SAY "MAIN"
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 11,31 SAY "PLEASE INSURE THAT YOU"
@ 12,31 SAY "HAVE THE ' CAPS LOCK '"
@ 13,31 SAY "ON AS ALL ANSWERS TO"
@ 14,31 SAY "QUESTIONS NEED TO BE"
@ 15,31 SAY "IN UPPER CASE"
@ 17,31 SAY "TEST HERE"
@ 17,42 GET test
@ 18,31 SAY "PRESS RETURN TO CONTINUE"
READ
STORE .f. TO one_time
SAVE TO mem_var
do while .t.
clear
@ 0,1 SAY "MAIN"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,36 SAY "MAIN MENU"
@ 6,22 SAY "1)   DICTIONARY MAINTENANCE"
@ 8,22 SAY "2)   DICTIONARY OUTPUT"
@ 10,22 SAY "3)   DICTIONARY QUERY"
@ 12,22 SAY "4)   SCHEMA MAINTENANCE"
@ 14,22 SAY "5)   SCHEMA OUTPUT"
@ 16,22 SAY "6)   EXIT DICTIONARY SYSTEM"
@ 17,22 SAY " "
ACCEPT '         ENTER YOUR CHOICE (1-6) FROM ABOVE: ' TO choice
DO CASE
CASE choice = "1"
do 110000
CASE choice = "2"
DO 120000
CASE choice = "3"
DO 130000
CASE choice = "4"
DO 140000
CASE choice = "5"
DO 150000
CASE choice = "6"
CLEAR
RELEASE ALL
```

```
RETURN
OTHERWISE
CLEAR
@ 2,4 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 6 ONLY"
@ 3,4 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 110000.PRG
* MODULE NAME: 1.1.0.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: MAIN, 1.1.1.0.0.0, 1.1.2.0.0.0, 1.1.3.0.0.0
* 1.1.4.0.0.0, 1.1.5.0.0.0.
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0, 1.1.2.0.0.0, 1.1.3.0.0.0,
* 1.1.4.0.0.0, 1.1.5.0.0.0, MAIN.
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS FOR THE MAINTENANCE OF ENTITY RELATIONS,
* AND RELATIONSHIP RELATIONS.
*
do while .t.
CLEAR
@ 0,1 SAY "1.1.0.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,31 SAY "MAINTENANCE  MENU"
@ 6,22 SAY "1)   ADD ENTITY"
@ 8,22 SAY "2)   MODIFY ENTITY"
@ 10,22 SAY "3)   DELETE ENTITY"
@ 12,22 SAY "4)   ADD RELATIONSHIP"
@ 14,22 SAY "5)   DELETE RELATIONSHIP"
@ 16,22 SAY "6)   RETURN TO MAIN MENU"
@ 17,22 SAY "  "
ACCEPT '        ENTER YOUR CHOICE (1-6) FROM ABOVE: ' TO choice
DO CASE
CASE choice = "1"
do 111000
CASE choice = "2"
DO 112000
CASE choice = "3"
DO 113000
CASE choice = "4"
DO 114000
CASE choice = "5"
DO 115000
CASE choice = "6"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 2,18 SAY choice
@ 2,21 SAY "IS NOT A VALID CHOICE"
@ 3,18 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 6 ONLY"
@ 4,18 SAY "PRESS RETURN TO TRY AGAIN!"
WAIT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 111000.PRG
* MODULE NAME: 1.1.1.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.1.1.0.0, 1.1.1.2.0.0, 1.1.1.3.0.0,
* 1.1.1.4.0.0, 1.1.1.5.0.0, 1.1.1.6.0.0, 1.1.1.7.0.0, 1.1.1.8.0.0, 1.1.0.0.0.0
* MAIN
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RALATION
* TO ADD TUPLES TO.
*
set color to 0/3,3
set talk off
CLEAR
do while .t.
CLEAR
@ 0,1 SAY "1.1.1.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "ADD ENTITY"
@ 6,15 SAY "1)   USER                  6)   FILE"
@ 8,15 SAY "2)   SYSTEM                7)   RECORD"
@ 10,15 SAY "3)   PROGRAM               8)   ELEMENT"
@ 12,15 SAY "4)   MODULE                9)   RETURN TO PREVIOUS MENU"
@ 14,15 SAY "5)   DOCUMENT             10)   RETURN TO MAIN MENU"
@ 15,22 SAY " "
ACCEPT '          ENTER YOUR CHOICE (1-10) FROM ABOVE: ' TO choice
SET EXACT ON
DO CASE
CASE choice = "1"
do 111100
CASE choice = "2"
DO 111200
CASE choice = "3"
DO 111300
CASE choice = "4"
DO 111400
CASE choice = "5"
DO 111500
CASE choice = "6"
DO 111600
CASE choice = "7"
DO 111700
CASE choice = "8"
DO 111800
CASE choice = "9"
RETURN
CASE choice = "10"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 2,3 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 10 ONLY"
@ 3,3 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 111100.PRG
* MODULE NAME : 1.1.1.1.0.0
* INPUT FILES : USER
* OUTPUT FILES: USER
* ROUTINES THAT CALL THE MODLUE: 1.1.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0
* LOCAL VARIABLES USED:

* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*           CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* t       : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* INPUT FILES: USER
* OUTPUT FILES: USER

* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS THE USER TO ENTER NEW TUPLES TO THE USER RELATION.
*
USE
do while .t.
CLEAR
@ 0,1 SAY "1.1.1.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,36 SAY "ADD USER"
@ 6,22 SAY "This program will allow you to enter"
@ 7,22 SAY "additional tuples to the USER relation."
@ 8,22 SAY "Instructions for entering data are"
@ 9,22 SAY "provided at top of entry screen."
@ 10,22 SAY " "
wait to choice
SET MENU ON
USE USER
APPEND
SET MENU OFF
RETURN
```

```
* 111200.PRG
* MODULE NAME : 1.1.1.2.0.0
* INPUT FILES : USER
* OUTPUT FILES: USER
* ROUTINES THAT CALL THE MODLUE: 1.1.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: SYSTEM.
* OUTPUT FILES: SYSTEM.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS THE USER TO ENTER NEW TUPLES TO THE SYSTEM RELATION.
*
USE
do while .t.
CLEAR
@ 0,1 SAY "1.1.1.2.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "ADD SYSTEM"
@ 6,22 SAY "This program will allow you to enter"
@ 7,22 SAY "additional tuples to the SYSTEM relation."
@ 8,22 SAY "Instructions for entering data are"
@ 9,22 SAY "provided at top of entry screen."
@ 10,22 SAY " "
wait to choice
SET MENU ON
USE SYSTEM
APPEND
SET MENU OFF
RETURN
```

```
* 111300.PRG
* MODULE NAME : 1.1.1.3.0.0
* INPUT FILES : USER
* OUTPUT FILES: USER
* ROUTINES THAT CALL THE MODLUE: 1.1.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: PROGRAM.
* OUTPUT FILES: PROGRAM.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS THE USER TO ENTER NEW TUPLES TO THE PROGRAM RELATION.
*
USE
set color to 0/3,7/0,3
set talk off
do while .t.
CLEAR
@ 0,1 SAY "1.1.1.3.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "ADD PROGRAM"
@ 6,22 SAY "This program will allow you to enter"
@ 7,22 SAY "additional tuples to the PROGRAM relation."
@ 8,22 SAY "Instructions for entering data are"
@ 9,22 SAY "provided at top of entry screen."
@ 10,22 SAY " "
wait to choice
SET MENU ON
USE PROGRAM
APPEND
SET MENU OFF
RETURN
```

```
* 111400.PRG
* MODULE NAME : 1.1.1.4.0.0
* INPUT FILES : USER
* OUTPUT FILES: USER
* ROUTINES THAT CALL THE MODLUE: 1.1.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: MODULE.
* OUTPUT FILES: MODULE.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS THE USER TO ENTER NEW TUPLES TO THE MODULE RELATION.
*
USE
do while .t.
CLEAR
@ 0,1 SAY "1.1.1.4.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,36 SAY "ADD MODULE"
@ 6,22 SAY "This program will allow you to enter"
@ 7,22 SAY "additional tuples to the MODULE relation."
@ 8,22 SAY "Instructions for entering data are"
@ 9,22 SAY "provided at top of entry screen."
@ 10,22 SAY " "
wait to choice
SET MENU ON
USE MODULE
APPEND
SET MENU OFF
RETURN
```

```
* 111500.PRG
* MODULE NAME : 1.1.1.5.0.0
* INPUT FILES : USER
* OUTPUT FILES: USER
* ROUTINES THAT CALL THE MODLUE: 1.1.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: DOCUMENT.
* OUTPUT FILES: DOCUMENT.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS THE USER TO ENTER NEW TUPLES TO THE DOCUMENT RELATION.
*
USE
set color to 0/3,7/0,3
set talk off
do while .t.
CLEAR
@ 0,1 SAY "1.1.1.5.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,36 SAY "ADD DOCUMENT"
@ 6,22 SAY "This program will allow you to enter"
@ 7,22 SAY "additional tuples to the DOCUMENT relation."
@ 8,22 SAY "Instructions for entering data are"
@ 9,22 SAY "provided at top of entry screen."
@ 10,22 SAY " "
wait to choice
SET MENU ON
USE DOCUMENT
APPEND
SET MENU OFF
RETURN
```

```
* 111600.PRG
* MODULE NAME : 1.1.1.6.0.0
* INPUT FILES : USER
* OUTPUT FILES: USER
* ROUTINES THAT CALL THE MODLUE: 1.1.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: FILE.
* OUTPUT FILES: FILE.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS THE USER TO ENTER NEW TUPLES TO THE FILE RELATION.
*
USE
do while .t.
CLEAR
@ 0,1 SAY "1.1.1.6.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,36 SAY "ADD FILE"
@ 6,22 SAY "This program will allow you to enter"
@ 7,22 SAY "additional tuples to the FILE relation."
@ 8,22 SAY "Instructions for entering data are"
@ 9,22 SAY "provided at top of entry screen."
@ 10,22 SAY " "
wait to choice
SET MENU ON
USE FILE
APPEND
SET MENU OFF
RETURN
```

```
* 111700.PRG
* MODULE NAME : 1.1.1.7.0.0
* INPUT FILES : USER
* OUTPUT FILES: USER
* ROUTINES THAT CALL THE MODLUE: 1.1.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: RECORD.
* OUTPUT FILES: RECORD.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS THE USER TO ENTER NEW TUPLES TO THE RECORD RELATION.
*
USE
do while .t.
CLEAR
@ 0,1 SAY "1.1.1.7.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,36 SAY "ADD RECORD"
@ 6,22 SAY "This program will allow you to enter"
@ 7,22 SAY "additional tuples to the RECORD relation."
@ 8,22 SAY "Instructions for entering data are"
@ 9,22 SAY "provided at top of entry screen."
@ 10,22 SAY " "
wait to choice
SET MENU ON
USE RECORD
APPEND
SET MENU OFF
RETURN
```

```
* 111800.PRG
* MODULE NAME : 1.1.1.8.0.0
* INPUT FILES : USER
* OUTPUT FILES: USER
* ROUTINES THAT CALL THE MODLUE: 1.1.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: ELEMENT.
* OUTPUT FILES: ELEMENT.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS THE USER TO ENTER NEW TUPLES TO THE ELEMENT RELATION.
*
USE
do while .t.
CLEAR
@ 0,1 SAY "1.1.1.8.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,36 SAY "ADD ELEMENT"
@ 6,22 SAY "This program will allow you to enter"
@ 7,22 SAY "additional tuples to the ELEMENT relation."
@ 8,22 SAY "Instructions for entering data are"
@ 9,22 SAY "provided at top of entry screen."
@ 10,22 SAY " "
wait to choice
SET MENU ON
USE ELEMENT
APPEND
SET MENU OFF
RETURN
```

```
* 112000.PRG
* MODULE NAME: 1.1.2.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.2.1.0.0, 1.1.2.2.0.0, 1.1.2.3.0.0,
* 1.1.2.4.0.0, 1.1.2.5.0.0, 1.1.2.6.0.0, 1.1.2.7.0.0, 1.1.2.8.0.0, 1.1.0.0.0.0
* MAIN
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* INPUT FILE: MEM_VAR.
* OUTPUT FILE: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RELATION
* TO MODIFY.
*
do while .t.
CLEAR
@ 1,1 SAY "1.1.2.0.0.0"
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,35 SAY "MODIFY ENTITY"
@ 7,15 SAY "1)   USER                  6)   FILE"
@ 9,15 SAY "2)   SYSTEM                7)   RECORD"
@ 11,15 SAY "3)   PROGRAM               8)   ELEMENT"
@ 13,15 SAY "4)   MODULE                9)   RETURN TO PREVIOUS MENU"
@ 15,15 SAY "5)   DOCUMENT             10)   RETURN TO MAIN MENU"
@ 16,22 SAY " "
ACCEPT '          ENTER YOUR CHOICE (1-10) FROM ABOVE: ' TO choice
DO CASE
CASE choice = "1"
store 'USER' to choice
save to mem_var
do 112100
CASE choice = "2"
store 'SYSTEM' to choice
save to mem_var
DO 112100
CASE choice = "3"
store 'PROGRAM' to choice
save to mem_var
DO 112100
CASE choice = "4"
store 'MODULE' to choice
save to mem_var
DO 112100
CASE choice = "5"
store 'DOCUMENT' to choice
save to mem_var
DO 112100
CASE choice = "6"
store 'FILE' to choice
save to mem_var
DO 112100
CASE choice = "7"
store 'RECORD' to choice
save to mem_var
DO 112100
CASE choice = "8"
store 'ELEMENT' to choice
save to mem_var
DO 112100
CASE choice = "9"
RETURN
CASE choice = "10"
RETURN TO MASTER
```

```
OTHERWISE
CLEAR
@ 2,3 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 10 ONLY"
@ 3,3 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 112100.PRG
* MODULE NAME: 1.1.2.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.2.1.0.0, 1.1.2.2.0.0, 1.1.2.3.0.0,
* 1.1.2.4.0.0, 1.1.2.5.0.0, 1.1.2.6.0.0, 1.1.2.7.0.0, 1.1.2.8.0.0, 1.1.0.0.0.0
* MAIN

* LOCAL VARIABLES USED:

* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*           CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* hold    : USED TO STOP ACTION FOR USER DECISION.
* rec_num : CONTAINS THE VALUE OF THE POINTER TO THE TUPLE TO BE CHANGED.
* stop    : USED TO STOP ACTION FOR USER DECISION.
* t       : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* INPUT FILES: MEM_VAR, USER, SYSTEM, PROGRAM, MODULE, DOCUMENT, FILE, RECORD,
*              ELEMENT.
* OUTPUT FILES: MEM_VAR, USER, SYSTEM, PROGRAM, MODULE, DOCUMENT, FILE, RECORD,
*               ELEMENT.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RELATION
* TO MODIFY.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
STORE .t. TO TRUE
do while TRUE
CLEAR
@ 0,1 SAY "1.1.2.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "MODIFY ENTITY"
@ 7,24 SAY "ENTER TUPLE NUMBER OF THE"
@ 7,51 SAY choice
ACCEPT'                             YOU WISH TO MODIFY ' TO rec_num
IF (rec_num <= '0') .OR. (rec_num > '99999')
CLEAR
@ 1,24 SAY rec_num
@ 1,32 SAY "IS NOT A VALID RESPONSE"
@ 2,23 SAY "TUPLE NUMBER MUST BE GREATER THAN 0"
@ 3,23 SAY "AND LESS THAN 99999."
WAIT TO stop
ELSE
STORE .F. TO TRUE
ENDIF
ENDDO
DO CASE
CASE choice = 'USER'
USE USER
EDIT(VAL( rec_num))
RETURN
CASE choice = 'SYSTEM'
USE SYSTEM
EDIT(VAL(rec_num))
RETURN

CASE choice = 'PROGRAM'
USE PROGRAM
EDIT(VAL(rec_num))
RETURN
CASE choice = 'MODULE'
USE MODULE
```

```
EDIT(VAL(rec_num))
RETURN
CASE choice = 'DOCUMENT'
USE DOCUMENT
EDIT(VAL(rec_num))
RETURN
CASE choice = 'FILE'
USE FILE
EDIT(VAL(rec_num))
RETURN
CASE choice = 'RECORD'
USE RECORD
EDIT(VAL(rec_num))
RETURN
CASE choice = 'ELEMENT'
USE ELEMENT
EDIT(VAL(rec_num))
RETURN
@ 42,1 SAY "RETURN]"
```

```
* 113000.PRG
* MODULE NAME: 1.1.3.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.3.1.0.0, MAIN
* LOCAL VARIABLES USED:
* choice: CONTAINS THE NUMBER OF ACTION SELECTED ALSO USED TO TRANSFER THE
* RELATION NAME TO NEXT PROGRAM.
*      t: REPRESTENTS NO VALUE AT ALL.
*   hold: USED TO STOP ACTION FOR USER DECISION.
* INPUT FILE: MEM_VAR.
* OUTPUT FILE: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RELATION
* TO MODIFY.
*
SET EXACT ON
set color to 0/3,3
set talk off
CLEAR
do while .t.
ERASE mem_var.mem
CLEAR
@ 1,1 SAY "1.1.3.0.0.0"
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,35 SAY "DELETE ENTITY"
@ 7,15 SAY "1)   USER                6)   FILE"
@ 9,15 SAY "2)   SYSTEM              7)   RECORD"
@ 11,15 SAY "3)   PROGRAM             8)   ELEMENT"
@ 13,15 SAY "4)   MODULE              9)   RETURN TO PREVIOUS MENU"
@ 15,15 SAY "5)   DOCUMENT           10)   RETURN TO MAIN MENU"
@ 16,22 SAY " "
ACCEPT '         ENTER YOUR CHOICE (1-10) FROM ABOVE: ' TO choice
DO CASE
CASE choice = "1"
store 'USER' to choice
save to mem_var
do 113100
CASE choice = "2"
store 'SYSTEM' to choice
save to mem_var
DO 113100
CASE choice = "3"
store 'PROGRAM' to choice
save to mem_var
DO 113100
CASE choice = "4"
store 'MODULE' to choice
save to mem_var
DO 113100
CASE choice = "5"
store 'DOCUMENT' to choice
save to mem_var
DO 113100
CASE choice = "6"
store 'FILE' to choice
save to mem_var
DO 113100
CASE choice = "7"
stcre 'RECORD' to choice
save to mem_var
DO 113100
CASE choice = "8"
store 'ELEMENT' to choice
save to mem_var
```

```
DO 113100
CASE choice = "9"
RETURN
CASE choice = "10"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 2,18 SAY choice
@ 2,21 SAY "IS NOT A VALID CHOICE
@ 3,18 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 10 ONLY"
@ 4,21 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 113100.PRG
* MODULE NAME: 1.1.3.1.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.3.0.0.0
* LOCAL VARIABLES USED:
* choice  : CONTAINS THE NUMBER OF ACTION SELECTED.
* t       : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* stop    : USED TO STOP ACTION FOR USER DECISION.
* true    : USED AS A BOOLEAN VALUE IN LOOPS.
* rec_num : CONTAINS THE VALUE REPRESENTING THE RECORD CHANGED.
* INPUT FILES: USER, SYSTEM, PROGRAM, MODULE, DOCUMENT, FILE, RECORD, ELEMENT
* OUTPUT FILES: USER, SYSTEM, PROGRAM, MODULE, DOCUMENT, FILE, RECORD, ELEMENT
* mem_var.mem
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RELATION
* TO DELETE TUPLES FROM.
*
SET MENU ON
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
STORE .t. TO TRUE
do while TRUE
CLEAR
@ 0,1 SAY "1.1.3.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "DELETE ENTITY"
@ 7,24 SAY "ENTER TUPLE NUMBER OF THE"
@ 7,51 SAY choice
@ 8,24 SAY "TUPLE YOU WISH TO HAVE DELETED."
@ 9,24 SAY "THE RECORD WILL BE DISPLAYED"
@ 10,24 SAY "FOR YOU TO EXAMINE.  IF YOU ARE"
@ 11,24 SAY "SURE THAT YOU ARE DELETING THE"
@ 12,24 SAY "RIGHT RECORD DEPRESS  ¬U . "
@ 14,24 SAY "IF YOU DO NOT WANT IT DELETED DEPRESS"
@ 16,24 SAY "'0'  TO RETURN TO MAINTENANCE MENU."
ACCEPT'                            ENTER THE TUPLE NUMBER NOW ' TO rec_num
IF rec_num > '99999'
CLEAR
@ 1,24 SAY rec_num
@ 1,32 SAY "IS NOT A VALID RESPONSE"
@ 2,23 SAY "TUPLE NUMBER MUST BE GREATER THAN 0"
@ 3,23 SAY "AND LESS THAN 99999."
WAIT TO stop
ELSE
IF REC_NUM <= '0'
RETURN
STORE .F. TO TRUE
ENDIF
ENDDO
DO CASE
CASE choice = 'USER'
USE USER
EDIT(VAL( rec_num))
RETURN
CASE choice = 'SYSTEM'
USE SYSTEM
EDIT(VAL(rec_num))
RETURN
CASE choice = 'PROGRAM'
USE PROGRAM
EDIT(VAL(rec_num))
RETURN
```

```
CASE choice = 'MODULE'
USE MODULE
EDIT(VAL(rec_num))
RETURN
CASE choice = 'DOCUMENT'
USE DOCUMENT
EDIT(VAL(rec_num))
RETURN
CASE choice = 'FILE'
USE FILE
EDIT(VAL(rec_num))
RETURN
CASE choice = 'RECORD'
USE RECORD
EDIT(VAL(rec_num))
RETURN
CASE choice = 'ELEMENT'
USE ELEMENT
EDIT(VAL(rec_num))
RETURN
ENDCASE
```

```
* 114000.PRG
* MODULE NAME: 1.1.4.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.4.1.0.0, MAIN
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* hold     : USED TO STOP THE SCREEN OUTPUT FOR A USER DECISION.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* title    : CONTAINS THE CHARACTER STRING THAT DESCRIBES THE RELATIONSHIP
*            BEING ADDED TO, DELETED FROM OR OUTPUT.
* INPUT FILES: MEM_VAR
* OUTPUT FILES: MEM_VAR
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH RELATIONSHIP HE WOULD
* LIKE TO ADD TUPLES TO.
*
CLEAR
do while .t.
ERASE mem_var.mem
CLEAR
@ 0,1 SAY "1.1.4.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,32 SAY "ADD TO RELATIONSHIP"
@ 5,9 SAY "1)   USER CONTAINS SYSTEM         8)   FILE CONTAINS REC"
@ 5,64 SAY "ORDS"
@ 7,9 SAY "2)   SYSTEM CONTAINS PROGRAM      9)   RECORD CONTAINS E"
@ 7,64 SAY "LEMENT"
@ 9,9 SAY "3)   PROGRAM PROCESSES FILE      10)   USER RESPONSIBLE"
@ 9,64 SAY "FOR SYSTEM"
@ 11,9 SAY "4)   PROGRAM PROCESSES RECORD   11)   USER RESPONSIBLE"
@ 11,64 SAY "FOR FILE"
@ 13,9 SAY "5)   PROGRAM PROCESSES ELEMENT  12)   PROGRAM PRODUCES"
@ 13,64 SAY "DOCUMENT"
@ 15,9 SAY "6)   SYSTEM CONTAINS PROGRAM    13)   RETURN TO PREVIOU"
@ 15,64 SAY "S MENU"
@ 17,9 SAY "7)   PROGRAM CONTAINS MODULE    14)   RETURN TO MAIN ME"
@ 17,64 SAY "NU"
@ 18,22 SAY " "
ACCEPT '         ENTER YOUR CHOICE (1-14) FROM ABOVE: ' TO choice
DO CASE
CASE choice = "1"
store 'U_PROC_S' to choice
store 'USER-PROCESSES-SYSTEM' TO title
save to mem_var
do 114100
CASE choice = "2"
store 'S_PROC_P' to choice
store 'SYSTEM-PROCESSES-PROGRAM' TO title
save to mem_var
do 114100
CASE choice = "3"
store 'P_PROC_F' to choice
store 'PROGRAM-PROCESSES-FILE' TO title
save to mem_var
do 114100
CASE choice = "4"
store 'P_PROC_R' to choice
store 'PROGRAM-PROCESSES-RECORD' TO title
save to mem_var
do 114100
CASE choice = "5"
```

```
store 'P_PROC_E' to choice
store 'PROGRAM-PROCESSES-ELEMENT' TO title
save to mem_var
do 114100
CASE choice = "6"
store 'S_CONT_P' to choice
store 'SYSTEM-CONTAINS-PROGRAM' TO title
save to mem_var
do 114100
CASE choice = "7"
store 'P_CONT_M' to choice
store 'PROGRAM-CONTAINS-MODULE' TO title
save to mem_var
do 114100
CASE choice = "8"
store 'F_CONT_R' to choice
store 'FILE-CONTAINS-RECORD' TO title
save to mem_var
do 114100
CASE choice = "9"
store 'R_CONT_E' to choice
store 'RECORD-CONTAINS-ELEMENT' TO title
save to mem_var
do 114100
CASE choice = "10"
store 'U_RESP_S' to choice
store 'USER-RESPONSIBLE-FOR-SYSTEM' TO title
save to mem_var
do 114100
CASE choice = "11"
store 'U_RESP_F' to choice
store 'USER-RESPONSIBLE-FOR-FILE' TO title
save to mem_var
do 114100
CASE choice = "12"
store 'P_PROD_D' to choice
store 'PROGRAM-PRODUCES-DOCUMENT' TO title
save to mem_var
do 114100
CASE choice = "13"
RETURN
CASE choice = "14"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 1,21 SAY choice
@ 1,28 SAY "IS NOT A VALID CHOICE"
@ 2,20 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 14 ONLY"
@ 3,20 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 114100.PRG
* MODULE NAME: 1.1.4.1.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.4.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.4.0.0.0
* LOCAL VARIABLES USED:
* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*           CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* hold    : USED TO STOP ACTION FOR USER DECISION.
* t       : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* title   : CONTAINS THE CHARACTER STRING THAT DESCRIBES THE RELATIONSHIP
*           BEING ADDED TO, DELETED FROM OR OUTPUT.
* INPUT FILES: MEM_VAR, USER, SYSTEM, PROGRAM, MODULE, DOCUMENT, FILE, RECORD,
*              ELEMENT, U_CONTS, U_CONT_S, U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PRED_D.
* OUTPUT FILES: MEM_VAR, USER, SYST, PROGRAM, MODULE, DOCUMENT, FILE, RECORD,
*               ELEMENT, TEMP U_CONTS, U_CONT_S, U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PRED_D.

* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW FOR THE ACTUAL INPUT OF ADDITIONAL TUPLES TO THE
* RELATIONSHIP RELATION SELECTED.
*
CLEAR
do while .t.
RESTORE FROM mem_var
CLEAR
@ 0,1 SAY "1.1.4.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,32 SAY "ADD RELATIONSHIP"
@ 8,22 SAY "YOU ARE ABOUT TO BEGIN ADDING TUPLES"
@ 9,22 SAY "TO THE"
@ 9,30 SAY TITLE
@ 10,22 SAY "RELATION."
WAIT TO STOP
DO CASE
CASE choice = "U_PROC_S"
USE U_PROC_S
APPEND
RETURN
CASE choice = "S_PROC_P"
USE S_PROC_P
APPEND
RETURN
CASE choice = "P_PROC_F"
USE P_PROC_F
APPEND
RETURN
CASE choice = "P_PROC_R"
USE P_PROC_R
APPEND
RETURN
CASE choice = "P_PROC_E"
USE P_PROC_E
APPEND
RETURN
CASE choice = "S_CONT_P"
USE S_CONT_P
APPEND
RETURN
CASE choice = "P_CONT_M"
```

```
USE P_CONT_M
APPEND
RETURN
CASE choice = "F_CONT_R"
USE F_CONT_R
APPEND
RETURN
CASE choice = "R_CONT_E"
USE R_CONT_E
APPEND
RETURN
CASE choice = "U_RESP_S"
USE U_RESP_S
APPEND
RETURN
CASE choice = "U_RESP_F"
USE U_RESP_F
APPEND
RETURN
CASE choice = "P_PROD_D"
USE P_PROD_D
APPEND
RETURN
CASE choice = "13"
RETURN
CASE choice = "14"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 1,21 SAY choice
@ 1,28 SAY "IS NOT A VALID CHOICE"
@ 2,20 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 14 ONLY"
@ 3,20 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 115000.PRG
* MODULE NAME: 1.1.5.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.5.1.0.0, MAIN
* LOCAL VARIABLES USED:
* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
* `         CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* hold    : USED TO STOP ACTION FOR USER DECISION.
* t       : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* title   : CONTAINS THE CHARACTER STRING THAT DESCRIBES THE RELATIONSHIP
*           BEING ADDED TO, DELETED FROM OR OUTPUT.
* INPUT FILE  : MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH RELATIONSHIP HE WOULD
* LIKE TO DELETE TUPLES FROM.
*
do while .t.
ERASE mem_var.mem
CLEAR
@ 0,1 SAY "1.1.5.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,29 SAY "DELETE FROM RELATIONSHIP"
@ 5,9 SAY "1)   USER CONTAINS SYSTEM         8)   FILE CONTAINS REC"
@ 5,64 SAY "ORDS"
@ 7,9 SAY "2)   SYSTEM CONTAINS PROGRAM      9)   RECORD CONTAINS E"
@ 7,64 SAY "LEMENT"
@ 9,9 SAY "3)   PROGRAM PROCESSES FILE      10)   USER RESPONSIBLE"
@ 9,64 SAY "FOR SYSTEM"
@ 11,9 SAY "4)   PROGRAM PROCESSES RECORD   11)   USER RESPONSIBLE"
@ 11,64 SAY "FOR FILE"
@ 13,9 SAY "5)   PROGRAM PROCESSES ELEMENT  12)   PROGRAM PRODUCES"
@ 13,64 SAY "DOCUMENT"
@ 15,9 SAY "6)   SYSTEM CONTAINS PROGRAM    13)   RETURN TO PREVIOU"
@ 15,64 SAY "S MENU"
@ 17,9 SAY "7)   PROGRAM CONTAINS MODULE    14)   RETURN TO MAIN ME"
@ 17,64 SAY "NU"
@ 18,22 SAY " "
ACCEPT '          ENTER YOUR CHOICE (1-14) FROM ABOVE: ' TO choice
DO CASE
CASE choice = "1"
store 'U_PROC_S' to choice
store 'USER-PROCESSES-SYSTEM' TO title
save to mem_var
do 115100
CASE choice = "2"
store 'S_PROC_P' to choice
store 'SYSTEM-PROCESSES-PROGRAM' TO title
save to mem_var
do 115100
CASE choice = "3"
store 'P_PROC_F' to choice
store 'PROGRAM-PROCESSES-FILE' TO title
save to mem_var
do 115100
CASE choice = "4"
store 'P_PROC_R' to choice
store 'PROGRAM-PROCESSES-RECORD' TO title
save to mem_var
do 115100
CASE choice = "5"
store 'P_PROC_E' to choice
store 'PROGRAM-PROCESSES-ELEMENT' TO title
save to mem_var
do 115100
CASE choice = "6"
store 'S_CONT_P' to choice
store 'SYSTEM-CONTAINS-PROGRAM' TO title
save to mem_var
do 115100
CASE choice = "7"
store 'P_CONT_M' to choice
store 'PROGRAM-CONTAINS-MODULE' TO title
save to mem_var
do 115100
CASE choice = "8"
store 'F_CONT_R' to choice
store 'FILE-CONTAINS-RECORD' TO title
save to mem_var
do 115100
CASE choice = "9"
store 'R_CONT_E' to choice
store 'RECORD-CONTAINS-ELEMENT' TO title
save to mem_var
do 115100
CASE choice = "10"
store 'U_RESP_S' to choice
store 'USER-RESPONSIBLE-FOR-SYSTEM' TO title
save to mem_var
do 115100
CASE choice = "11"
store 'U_RESP_F' to choice
store 'USER-RESPONSIBLE-FOR-FILE' TO title
save to mem_var
do 115100
CASE choice = "12"
store 'P_PROD_D' to choice
store 'PROGRAM-PRODUCES-DOCUMENT' TO title
save to mem_var
do 115100
CASE choice = "13"
RETURN
CASE choice = "14"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 1,21 SAY choice
@ 1,28 SAY "IS NOT A VALID CHOICE"
@ 2,20 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 14 ONLY"
@ 3,20 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 115100.PRG
* MODULE NAME: 1.1.5.1.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.5.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.1.5.0.0.0
* LOCAL VARIABLES USED:
* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*           CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* hold    : USED TO STOP ACTION FOR USER DECISION.
* rec_num : CONTAINS THE VALUE OF THE POINTER TO THE TUPLE TO BE CHANGED.
* t       : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* title   : CONTAINS THE CHARACTER STRING THAT DESCRIBES THE RELATIONSHIP
*           BEING ADDED TO, DELETED FROM OR OUTPUT.
* INPUT FILES: MEM_VAR, U_CONTS, U_CONT_S, U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PRED_D.
* OUTPUT FILES: MEM_VAR, U_CONTS, U_CONT_S, U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PRED_D.

* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW FOR THE ACTUAL DELETION INPUT OF ADDITIONAL TUPLES
* FROM THE DESIGNATED RELATIONSHIP FILE SELECTED.
*
do while .t.
RESTORE FROM mem_var
CLEAR
@ 0,1 SAY "1.1.5.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,29 SAY "DELETE FROM RELATIONSHIP"
@ 8,21 SAY "ENTER TUPLE NUMBER OF THE"
@ 10,24 SAY TITLE
@ 12,21 SAY "TUPLE THAT YOU WISH TO HAVE DELETED."
@ 13,21 SAY "THE TUPLE WILL BE DISPLAYED FOR"
@ 14,21 SAY "YOU TO EXAMINE.  IF YOU ARE"
@ 15,21 SAY "SURE THAT YOU ARE DELETING THE"
@ 16,21 SAY "RIGHT TUPLE, DEPRESS  ¬U .  IF"
@ 17,21 SAY "YOU DO NOT WANT IT DELETED,"
@ 18,21 SAY "TYPE  0 FOR TUPLE NUMBER"
@ 19,21 SAY "TO RETURN TO PREVIOUS MENU."
@ 20,21 SAY " "
ACCEPT'                         ENTER THE TUPLE NUMBER NOW ' TO rec_num
DO WHILE rec_num <> '0'
DO CASE
CASE choice = "U_PROC_S"
USE U_PROC_S
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "S_PROC_P"
USE S_PROC_P
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "P_PROC_F"
USE P_PROC_F
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "P_PROC_R"
USE P_PROC_R
GOTO (VAL(rec_num))
EDIT
```

```
RETURN
CASE choice = "P_PROC_E"
USE P_PROC_E
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "S_CONT_P"
USE S_CONT_P
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "P_CONT_M"
USE P_CONT_M
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "F_CONT_R"
USE F_CONT_R
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "R_CONT_E"
USE R_CONT_E
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "U_RESP_S"
USE U_RESP_S
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "U_RESP_F"
USE U_RESP_F
GOTO (VAL(rec_num))
EDIT
RETURN
CASE choice = "P_PROD_D"
USE P_PROD_D
GOTO (VAL(rec_num))
EDIT
RETURN
ENDCASE
ENDDO
RETURN
```

```
* 120000.PRG
* MODULE NAME: 1.2.0.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: MAIN
* ROUTINES THAT THE MODULE CALLS:1.2.1.0.0.0, 1.2.2.0.0.0, MAIN.
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                        t: REPRESTENTS NO VALUE AT ALL.
*                        hold: USED TO STOP ACTION FOR USER DECISION.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS THE USER TO SELECT ENTITY RELATIONS,
* AND RELATIONSHIP RELATIONS FOR OUTPUT.
*
do while .t.
CLEAR
@ 0,1 SAY "1.2.0.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,31 SAY "DICTIONARY OUTPUT"
@ 6,22 SAY "1)   ENTITY"
@ 8,22 SAY "2)   RELATIONSHIP"
@ 10,22 SAY "3)   RETURN TO MAIN MENU"
@ 11,22 SAY " "
ACCEPT '         ENTER YOUR CHOICE (1-3) FROM ABOVE: ' TO choice
DO CASE
CASE choice = "1"
do 121000
CASE choice = "2"
DO 122000
CASE choice = "3"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 2,18 SAY choice
@ 2,21 SAY "IS NOT A VALID CHOICE"
@ 3,18 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
@ 4,18 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 121000.PRG
* MODULE NAME: 1.2.1.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.0.0.0.0, 1.2.1.1.0.0 MAIN
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                        t: REPRESTENTS NO VALUE AT ALL.
*                        hold: USED TO STOP ACTION FOR USER DECISION.
* INPUT FILE : MEM_VAR.
* OUTPUT FILE: MEM_VAR
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RELATION
* TO OUTPUT.
*
do while .t.
ERASE mem_var.mem
CLEAR
@ 0,1 SAY "1.2.1.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,34 SAY "ENTITY OUTPUT"
@ 6,15 SAY "1)   USER                 6)   FILE"
@ 8,15 SAY "2)   SYSTEM               7)   RECORD"
@ 10,15 SAY "3)   PROGRAM              8)   ELEMENT"
@ 12,15 SAY "4)   MODULE               9)   RETURN TO PREVIOUS MENU"
@ 14,15 SAY "5)   DOCUMENT            10)   RETURN TO MAIN MENU"
@ 15,1 SAY " "
ACCEPT'          ENTER YOUR CHOICE (1-10) FROM ABOVE: 'TO choice
DO CASE
CASE choice = "1"
store 'USER' to choice
save to mem_var
do 121100
CASE choice = "2"
store 'SYSTEM' to choice
save to mem_var
DO 121100
CASE choice = "3"
store 'PROGRAM' to choice
save to mem_var
DO 121100
CASE choice = "4"
store 'MODULE' to choice
save to mem_var
DO 121100
CASE choice = "5"
store 'DOCUMENT' to choice
save to mem_var
DO 121100
CASE choice = "6"
store 'FILE' to choice
save to mem_var
DO 121100
CASE choice = "7"
store 'RECORD' to choice
save to mem_var
DO 1211000
CASE choice = "8"
store 'ELEMENT' to choice
save to mem_var
DO 121100
CASE choice = "9"
RETURN
CASE choice = "10"
RETURN TO MASTER
OTHERWISE
```

```
CLEAR
@ 1,23 SAY choice
@ 1,31 SAY "IS NOT A VALID CHOICE"
@ 2,18 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 10 ONLY"
@ 3,18 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 121100.PRG
* MODULE NAME: 1.2.1.1.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.1.0.0.0
* LOCAL VARIABLES USED:
* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*           CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* hold    : USED TO STOP ACTION FOR USER DECISION.
* option  : CONTAINS THE USER'S CHOICE ON WHETHER TO OUTPUT TO THE SCREEN
*           OR THE PRINTER.
* t       : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* true    : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR
* OUTPUT FILES: MEM_VAR
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHETHER THE OUTPUT WILL BE
* DISPLAYED ON THE SCREEN OR PRINTED.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
STORE .t. TO TRUE
do while TRUE
CLEAR
@ 0,1 SAY "1.2.1.1.0.0"
RESTORE FROM mem_var
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,33 SAY "ENTITY OUTPUT"
@ 8,23 SAY "LISTED BELOW ARE THE CHOICES FOR HOW"
@ 9,23 SAY "YOU CAN HAVE THE RELATION"
@ 9,50 SAY CHOICE
@ 10,23 SAY "DISPLAYED."
@ 12,28 SAY "1)  SCREEN OUTPUT"
@ 14,28 SAY "2)  PRINTER OUPUT"
@ 16,28 SAY "3)  RETURN TO PREVIOUS MENU"
@ 17,1 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-3) FROM ABOVE 'TO option
ERASE mem_var.mem
SAVE TO mem_var
DO CASE
CASE option = '1'
DO CASE
CASE CHOICE = 'USER'
DO 121110
CASE choice = 'SYSTEM'
DO 121110
CASE CHOICE = 'PROGRAM'
DO 121110
CASE choice = 'MODULE'
DO 121110
CASE CHOICE = 'DOUCMENT'
DO 121120
CASE choice = 'FILE'
DO 121120
CASE CHOICE = 'RECORD'
DO 121120
CASE choice = 'ELEMENT'
DO 121120
ENDCASE
CASE option = '2'
DO CASE
CASE CHOICE = 'USER'
DO 121130
```

```
CASE choice = 'SYSTEM'
DO 121130
CASE CHOICE = 'PROGRAM'
DO 121130
CASE choice = 'MODULE'
DO 121130
CASE CHOICE = 'DOUCMENT'
DO 121140
CASE choice = 'FILE'
DO 121140
CASE CHOICE = 'RECORD'
DO 121140
CASE choice = 'ELEMENT'
DO 121140
ENDCASE
CASE option = '3'
RETURN
OTHERWISE
CLEAR
@ 0,27 SAY option
@ 0,34 SAY "IS NOT A VALID CHOICE"
@ 1,26 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
ACCEPT TO hold
ENDCASE
ENDDO
```

```
* 121110.PRG
* MODULE NAME: 1.2.1.1.1.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.1.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.1.1.0.0
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
* t: REPRESTENTS NO VALUE AT ALL.
* stop, hold: USED TO STOP ACTION FOR USER DECISION.
* count: KEEPS TRACK OF ACCOUNT NUMBERS.
* INPUT FILE: MEM_VAR.
* OUTPUT FILE: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL DISPLAY ON THE SCREEN USER, SYSTEM,
* PROGRAM AND MODULE RELATIONS
*RESTORE FROM mem_var
CLEAR
@ 0,1 SAY "1.2.1.1.1.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,30 SAY "ENTITY SCREEN OUTPUT"
@ 5,22 SAY "THIS MODULE WILL DISPLAY"
@ 5,48 SAY choice
@ 7,22 SAY "IF YOU DO NOT WISH TO DISPLAY"
@ 8,22 SAY "THIS ENTITY, TYPE '0' TO"
@ 9,22 SAY "RETURN TO THE PREVIOUS MENU."
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
DO CASE
CASE choice = 'USER'
CLEAR
USE USER
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 SAY DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 SAY COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
```

```
CASE choice = 'SYSTEM'
USE SYSTEM
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 SAY DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 SAY COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'PROGRAM'
USE PROGRAM
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 SAY DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 SAY COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'MODULE'
USE MODULE
```

```
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY CHOICE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY ACC_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY ID_NAME
@ 8,1 SAY "DATE TUPLE ADDED:"
@ 8,28 SAY DATE_ADDED
@ 9,1 SAY "TUPLE ADDED BY:"
@ 9,28 SAY ADDED_BY
@ 10,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 10,28 SAY LST_MOD_DT
@ 11,1 SAY "TUPLE LAST MODIFIED BY:"
@ 11,28 SAY LST_MOD_BY
@ 12,1 SAY "NUMBER OF MODIFICATIONS:"
@ 12,28 SAY NUM_OF_MOD
@ 13,1 SAY "DESCRIPTION:"
@ 11,28 SAY DESCRIPT
@ 17,1 SAY "COMMENTS:"
@ 15,28 SAY COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
ENDCASE
```

```
* 121120.PRG
* MODULE NAME: 1.2.1.1.2.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.1.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.1.1.0.0
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
* t: REPRESTENTS NO VALUE AT ALL.
* stop, hold: USED TO STOP ACTION FOR USER DECISION.
* count: KEEPS TRACK OF ACCOUNT NUMBERS.
* INPUT FILE: MEM_VAR.
* OUTPUT FILE: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL DISPLAY ON THE SCREEN DOCUMENT, FILE,
* RECORD, AND ELEMENT RELATIONS.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
@ 0,1 SAY "1.2.1.1.2.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,30 SAY "ENTITY SCREEN OUTPUT"
@ 5,22 SAY "THIS MODULE WILL DISPLAY"
@ 5,48 SAY choice
@ 7,22 SAY "IF YOU DO NOT WISH TO DISPLAY THIS"
@ 8,22 SAY "ENTITY, TYPE '0' TO RETURN TO"
@ 9,22 SAY "PREVIOUS MENU."
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
DO CASE
CASE choice = 'DOCUMENT'
USE DOCUMENT
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
```

```
RETURN
CASE choice = 'FILE'
USE FILE
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'RECORD'
USE RECORD
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'ELEMENT'
```

```
USE ELEMENT
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
ENDCASE
```

```
* 121130.PRG
* MODULE NAME: 1.2.1.1.3.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.1.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.1.1.0.0
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
* t: REPRESTENTS NO VALUE AT ALL.
* stop, hold: USED TO STOP ACTION FOR USER DECISION.
* count: KEEPS TRACK OF ACCOUNT NUMBERS.
* INPUT FILE: MEM_VAR.
* OUTPUT FILE: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL OUTPUT THE USER, SYSTEM, PROGRAM AND MODULE
* RELATION FILES TO THE PRINTER.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
@ 0,1 SAY "1.2.1.1.3.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,29 SAY "ENTITY PRINTER OUTPUT"
@ 6,23 SAY "THIS MODULE WILL PRINT"
@ 6,47 SAY choice
@ 8,23 SAY "PLEASE INSURE THAT YOUR PRINTER"
@ 9,23 SAY "IS TURNED ON AND IN THE ONLINE"
@ 10,23 SAY "MODE"
@ 12,23 SAY "IF YOU DO NOT WISH TO PRINT"
@ 13,23 SAY "THIS ENTITY, TYPE '0' TO"
@ 14,23 SAY "RETURN TO THE PREVIOUS MENU"
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
SET DEVICE TO PRINT
SET CONSOLE OFF
DO CASE
CASE choice = 'USER'
USE USER
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 SAY DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 SAY COMMENTS
@ 18,1 SAY " "
SKIP
ENDDO
CASE choice = 'SYSTEM'
USE SYSTEM
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 SAY DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 SAY COMMENTS
@ 18,1 SAY " "
SKIP
ENDDO
CASE choice = 'PROGRAM'
USE PROGRAM
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 SAY DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15, 28 SAY COMMENTS
@ 18,1 SAY " "
SKIP
```

```
ENDDO
CASE choice = 'MODULE'
USE MODULE
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 SAY DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 SAY COMMENTS
@ 18,1 SAY " "
SKIP
ENDDO
ENDCASE
SET DEVICE TO SCREEN
SET CONSOLE ON
RETURN
```

```
* 121140.PRG
* MODULE NAME: 1.2.1.1.4.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.1.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.1.1.0.0
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
* t: REPRESTENTS NO VALUE AT ALL.
* stop, hold: USED TO STOP ACTION FOR USER DECISION.
* count: KEEPS TRACK OF ACCOUNT NUMBERS.
* INPUT FILE: MEM_VAR.
* OUTPUT FILE: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL OUTPUT THE FIRST FOUR RELATIONSHIP
* RELATION FILES TO THE PRINTER.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
@ 0,1 SAY "1.2.1.1.4.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,29 SAY "ENTITY PRINTER OUTPUT"
@ 6,23 SAY "THIS MODULE WILL PRINT"
@ 6,47 SAY choice
@ 8,23 SAY "PLEASE INSURE THAT YOUR PRINTER"
@ 9,23 SAY "IS TURNED ON AND IN THE ONLINE"
@ 10,23 SAY "MODE"
@ 12,23 SAY "IF YOU DO NOT WISH TO PRINT"
@ 13,23 SAY "THIS RELATION, TYPE '0' TO"
@ 14,23 SAY "RETURN TO THE PREVIOUS MENU"
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
SET DEVICE TO PRINT
SET CONSOLE OFF
DO CASE
CASE choice = 'DOCUMENT'
USE DOCUMENT
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 COMMENTS
@ 18,1 SAY " "
SKIP
ENDDO
CASE choice = 'FILE'
USE FILE
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 COMMENTS
@ 18,1 SAY " "
SKIP
ENDDO
CASE choice = 'RECORD'
USE RECORD
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 COMMENTS
@ 18,1 SAY " "
SKIP
```

```
ENDDO
CASE choice = 'ELEMENT'
USE ELEMENT
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY ACC_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY ID_NAME
@ 6,1 SAY "DATE TUPLE ADDED:"
@ 6,28 SAY DATE_ADDED
@ 7,1 SAY "TUPLE ADDED BY:"
@ 7,28 SAY ADDED_BY
@ 8,1 SAY "DATE TUPLE LAST MODIFIED:"
@ 8,28 SAY LST_MOD_DT
@ 9,1 SAY "TUPLE LAST MODIFIED BY:"
@ 9,28 SAY LST_MOD_BY
@ 10,1 SAY "NUMBER OF MODIFICATIONS:"
@ 10,28 SAY NUM_OF_MOD
@ 11,1 SAY "DESCRIPTION:"
@ 11,28 DESCRIPT
@ 15,1 SAY "COMMENTS:"
@ 15,28 COMMENTS
@ 18,1 SAY " "
SKIP
ENDDO
ENDCASE
SET DEVICE TO SCREEN
SET CONSOLE ON
RETURN
```

```
* 122100.PRG
* MODULE NAME: 1.2.2.1.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.2.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.2.0.0.0
* LOCAL VARIABLES USED:
* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*           CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* hold    : USED TO STOP ACTION FOR USER DECISION.
* option  : CONTAINS THE USER'S CHOICE ON WHETHER TO OUTPUT TO THE SCREEN
*           OR THE PRINTER.
* t       : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHETHER THE OUTPUT WILL BE
* DISPLAYED ON THE SCREEN OR PRINTED.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
STORE .t. TO TRUE
do while TRUE
CLEAR
@ 0,1 SAY "1.2.2.1.0.0"
RESTORE FROM mem_var
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,29 SAY "RELATIONSHIP OUTPUT"
@ 8,23 SAY "LISTED BELOW ARE THE CHOICES FOR"
@ 9,23 SAY "HOW YOU CAN HAVE THE RELATIONSHIP"
@ 11,24 SAY TITLE
@ 13,23 SAY "DISPLAYED."
@ 15,28 SAY "1)  SCREEN OUTPUT"
@ 17,28 SAY "2)  PRINTER OUPUT"
@ 19,28 SAY "3)  RETURN TO PREVIOUS MENU"
@ 20,1 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-3) FROM ABOVE 'TO option
ERASE mem_var.mem
SAVE TO mem_var
DO CASE
CASE option = '1'
DO CASE
CASE CHOICE = 'U_PROC_S'
DO 122110
CASE choice = 'S_PROC_P'
DO 122110
CASE CHOICE = 'P_PROC_F'
DO 122110
CASE choice = 'P_PROC_R'
DO 122110
CASE CHOICE = 'P_PROC_E'
DO 122120
CASE choice = 'S_CONT_P'
DO 122120
CASE CHOICE = 'P_CONT_M'
DO 122120
CASE choice = 'F_CONT_R'
DO 122120
CASE CHOICE = 'R_CONT_E'
DO 122130
CASE choice = 'U_RESP_S'
DO 122130
CASE CHOICE = 'U_RESP_F'
DO 122130
```

```
CASE choice = 'P_PROD_D'
DO 122130
ENDCASE
CASE option = '2'
DO CASE
CASE CHOICE = 'U_PROC_S'
DO 122140
CASE choice = 'S_PROC_P'
DO 122140
CASE CHOICE = 'P_PROC_F'
DO 122140
CASE choice = 'P_PROC_R'
DO 122140
CASE CHOICE = 'P_PROC_E'
DO 122150
CASE choice = 'S_CONT_P'
DO 122150
CASE CHOICE = 'P_CONT_M'
DO 122150
CASE choice = 'F_CONT_R'
DO 122150
CASE CHOICE = 'R_CONT_E'
DO 122160
CASE choice = 'U_RESP_S'
DO 122160
CASE CHOICE = 'U_RESP_F'
DO 122160
CASE choice = 'P_PROD_D'
DO 122160
ENDCASE
CASE option = '3'
RETURN
OTHERWISE
CLEAR
@ 0,27 SAY option
@ 0,34 SAY "IS NOT A VALID CHOICE"
@ 1,26 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
@ 2,26 SAY "PRESS RETURN AND TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
```

```
* 122110.PRG
* MODULE NAME: 1.2.2.1.1.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.2.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.2.1.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* count    : USED TO KEEP TRACK OF THE RECORD NUMBER BEING DISPLAYED.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* option   : CONTAINS THE USER'S CHOICE ON WHETHER TO OUTPUT TO THE SCREEN
*            OR THE PRINTER.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: MEM_VAR U_CONTS, S_CONT_P, P_PROC_F, P_PROC_R.
* OUTPUT FILES: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL DISPLAY ON THE FIRST FOUR RELATIONSHIP TO THE SCREEN.
*
RESTORE FROM mem_var
CLEAR
@ 0,1 SAY "1.2.2.1.1.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,28 SAY "RELATIONSHIP SCREEN OUTPUT"
@ 5,22 SAY "THIS MODULE WILL DISPLAY"
@ 7,23 SAY TITLE
@ 9,22 SAY "IF YOU DO NOT WISH TO DISPLAY"
@ 10,22 SAY "THIS RELATIONSHIP, TYPE '0' TO"
@ 11,22 SAY "RETURN TO THE PREVIOUS MENU."
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
DO CASE
CASE choice = 'U_PROC_S'
CLEAR
USE U_PROC_S
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY U_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY S_NAME
@ 9,1 SAY " "
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'S_PROC_P'
USE S_PROC_P
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY S_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY P_NAME
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'P_PROC_F'
USE P_PROC_F
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY P_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY F_NAME
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'P_PROC_R'
USE P_PROC_R
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY P_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY R_NAME
@ 8,1 SAY "COMMENTS:"
DISPLAY OFF COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
ENDCASE
* MODULE NAME: 1.2.2.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:TBD, MAIN
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* INPUT FILE: MEM_VAR.
* OUTPUT FILE: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH RELATIONSHIP HE WOULD
* LIKE TO DELETE TUPLES FROM.
```

```
*
do while .t.
ERASE mem_var.mem
CLEAR
@ 0,1 SAY "1.2.2.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,29 SAY "RELATIONSHIP OUTPUT"
@ 5,9 SAY "1)   USER CONTAINS SYSTEM        8)   FILE CONTAINS REC"
@ 5,64 SAY "ORDS"
@ 7,9 SAY "2)   SYSTEM CONTAINS PROGRAM     9)   RECORD CONTAINS E"
@ 7,64 SAY "LEMENT"
@ 9,9 SAY "3)   PROGRAM PROCESSES FILE     10)   USER RESPONSIBLE"
@ 9,64 SAY "FOR SYSTEM"
@ 11,9 SAY "4)   PROGRAM PROCESSES RECORD   11)   USER RESPONSIBLE"
@ 11,64 SAY "FOR FILE"
@ 13,9 SAY "5)   PROGRAM PROCESSES ELEMENT  12)   PROGRAM PRODUCES"
@ 13,64 SAY "DOCUMENT"
@ 15,9 SAY "6)   SYSTEM CONTAINS PROGRAM    13)   RETURN TO PREVIOU"
@ 15,64 SAY "S MENU"
@ 17,9 SAY "7)   PROGRAM CONTAINS MODULE    14)   RETURN TO MAIN ME"
@ 17,64 SAY "NU"
@ 18,22 SAY " "
ACCEPT '          ENTER YOUR CHOICE (1-14) FROM ABOVE:'TO choice
DO CASE
CASE choice = "1"
store 'U_PROC_S' to choice
store 'USER PROCESSES SYSTEM' TO title
save to mem_var
do 122100
CASE choice = "2"
store 'S_PROC_P' to choice
store 'SYSTEM PROCESSES PROGRAM' TO title
save to mem_var
do 122100
CASE choice = "3"
store 'P_PROC_F' to choice
store 'PROGRAM PROCESSES FILE' TO title
save to mem_var
do 122100
CASE choice = "4"
store 'P_PROC_R' to choice
store 'PROGRAM PROCESSES RECORD' TO title
save to mem_var
do 122100
CASE choice = "5"
store 'P_PROC_E' to choice
store 'PROGRAM PROCESSES ELEMENT' TO title
save to mem_var
do 122100
CASE choice = "6"
store 'S_CONT_P' to choice
store 'SYSTEM CONTAINS PROGRAM' TO title
save to mem_var
do 122100
CASE choice = "7"
store 'P_CONT_M' to choice
store 'PROGRAM CONTAINS MODULE' TO title
save to mem_var
do 122100
CASE choice = "8"
store 'F_CONT_R' to choice
store 'FILE CONTAINS RECORD' TO title
save to mem_var
do 122100
CASE choice = "9"
store 'R_CONT_E' to choice
store 'RECORD CONTAINS ELEMENT' TO title
save to mem_var
```

```
do 122100
CASE choice = "10"
store 'U_RESP_S' to choice
store 'USER RESPONSIBLE FOR SYSTEM' TO title
save to mem_var
do 122100
CASE choice = "11"
store 'U_RESP_F' to choice
store 'USER RESPONSIBLE FOR FILE' TO title
save to mem_var
do 122100
CASE choice = "12"
store 'P_PROD_D' to choice
store 'PROGRAM PRODUCES DOCUMENT' TO title
save to mem_var
do 122100
CASE choice = "13"
RETURN
CASE choice = "14"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 1,21 SAY choice
@ 1,28 SAY "IS NOT A VALID CHOICE"
@ 2,20 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 14 ONLY"
@ 3,20 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 122120.PRG
* MODULE NAME: 1.2.2.1.2.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.2.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.2.1.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* count    : USED TO KEEP TRACK OF THE RECORD NUMBER BEING DISPLAYED.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* option   : CONTAINS THE USER'S CHOICE ON WHETHER TO OUTPUT TO THE SCREEN
*            OR THE PRINTER.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: MEM_VAR P_PROC_E, S_CONT_P, P_CONT_M, F_CONT_R.
* OUTPUT FILES: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL DISPLAY THE NEXT FOUR RELATIONSHIP TO THE SCREEN.
*
RESTORE FROM mem_var
CLEAR
@ 0,1 SAY "1.2.2.1.2.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,28 SAY "RELATIONSHIP SCREEN OUTPUT"
@ 5,22 SAY "THIS MODULE WILL DISPLAY"
@ 7,23 SAY TITLE
@ 9,22 SAY "IF YOU DO NOT WISH TO DISPLAY"
@ 10,22 SAY "THIS RELATIONSHIP, TYPE '0' TO"
@ 11,22 SAY "RETURN TO THE PREVIOUS MENU."
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
DO CASE
CASE choice = 'P_PROC_E'
CLEAR
USE P_PROC_E
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY P_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY E_NAME
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'S_CONT_P'
USE S_CONT_P
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
```

```
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY S_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY P_NAME
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'P_CONT_M'
USE P_CONT_M
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY P_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY M_NAME
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'F_CONT_R'
USE F_CONT_R
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY F_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY R_NAME
@ 8,1 SAY "COMMENTS:"
DISPLAY OFF COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
ENDCASE
```

```
* 122130.PRG
* MODULE NAME: 1.2.2.1.3.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.2.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.2.1.0.0
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                        t: REPRESTENTS NO VALUE AT ALL.
*                        hold: USED TO STOP ACTION FOR USER DECISION.
*                        count: KEEPS TRACK OF ACCOUNT NUMBERS.
*                        option:
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL DISPLAY ON THE FIRST THREE RELATIONSHIP
* RELATIONS
*
SET EXACT ON
set color to 0/3,3
set talk off
set menu on
SET EXACT ON
RESTORE FROM mem_var
CLEAR
@ 0,1 SAY "1.2.2.1.3.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,28 SAY "RELATIONSHIP SCREEN OUTPUT"
@ 5,22 SAY "THIS MODULE WILL DISPLAY"
@ 7,23 SAY TITLE
@ 9,22 SAY "IF YOU DO NOT WISH TO DISPLAY"
@ 10,22 SAY "THIS RELATIONSHIP, TYPE '0' TO"
@ 11,22 SAY "RETURN TO THE PREVIOUS MENU."
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
DO CASE
CASE choice = 'R_CONT_E'
CLEAR
USE R_CONT_E
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY R_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY E_NAME
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'U_RESP_S'
USE U_RESP_S
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
```

```
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY U_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY S_NAME
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'U_RESP_F'
USE U_RESP_F
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY U_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY F_NAME
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
CASE choice = 'P_PROD_D'
USE P_PROD_D
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 2,33 SAY TITLE
@ 4,1 SAY "RECORD
"
@ 4,11 SAY count
store count + 1 to count
@ 6,1 SAY "ACCESS NAME:"
@ 6,28 SAY P_NAME
@ 7,1 SAY "IDENTIFICATION NAME:"
@ 7,28 SAY D_NAME
@ 8,1 SAY "COMMENTS:"
DISPLAY OFF COMMENTS
ACCEPT 'PRESS RETURN TO SEE NEXT TUPLE'TO hold
SKIP
ENDDO
RETURN
ENDCASE
```

```
* 122140.PRG
* MODULE NAME: 1.2.1.1.4.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.1.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.1.1.0.0
* LOCAL VARIABLES USED:
* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*           CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* count   : USED TO KEEP TRACK OF THE RECORD NUMBER BEING DISPLAYED.
* stop, hold    : USED TO STOP ACTION FOR USER DECISION.
* option  : CONTAINS THE USER'S CHOICE ON WHETHER TO OUTPUT TO THE SCREEN
*           OR THE PRINTER.
* t       : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL OUTPUT THE USER, SYSTEM, PROGRAM AND MODULE
* RELATION FILES TO THE PRINTER.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
@ 0,1 SAY "1.2.1.1.4.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,27 SAY "RELATIONSHIP PRINTER OUTPUT"
@ 6,23 SAY "THIS MODULE WILL PRINT"
@ 8,24 SAY TITLE
@ 10,23 SAY "PLEASE INSURE THAT YOUR PRINTER"
@ 11,23 SAY "IS TURNED ON AND IN THE ONLINE"
@ 12,23 SAY "MODE"
@ 14,23 SAY "IF YOU DO NOT WISH TO PRINT"
@ 15,23 SAY "THIS RELATIONSHIP, TYPE '0' TO"
@ 16,23 SAY "RETURN TO THE PREVIOUS MENU"
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
SET DEVICE TO PRINT
SET CONSOLE OFF
DO CASE
CASE choice = 'U_PROC_S'
USE U_PROC_S
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY U_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY S_NAME
SKIP
ENDDO
CASE choice = 'S_PROC_P'
USE S_PROC_P
STORE 1 TO count
SET HEADING OFF
```

```
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY S_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY P_NAME
SKIP
ENDDO
CASE choice = 'P_PROC_F'
USE P_PROC_F
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY P_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY F_NAME
SKIP
ENDDO
CASE choice = 'P_PROC_R'
USE P_PROC_R
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY P_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY R_NAME
SKIP
ENDDO
ENDCASE
SET DEVICE TO SCREEN
SET CONSOLE ON
RETURN
```

```
* 122000.PRG
* 122150.PRG
* MODULE NAME: 1.2.1.1.5.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.1.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.1.1.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* count    : USED TO KEEP TRACK OF THE RECORD NUMBER BEING DISPLAYED.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* option   : CONTAINS THE USER'S CHOICE ON WHETHER TO OUTPUT TO THE SCREEN
             OR THE PRINTER.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILE: P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL OUTPUT THE NEXT FOUR RELATIONSHIP
* RELATION FILES TO THE PRINTER.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
@ 0,1 SAY "1.2.1.1.5.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,27 SAY "RELATIONSHIP PRINTER OUTPUT"
@ 6,23 SAY "THIS MODULE WILL PRINT"
@ 8,24 SAY TITLE
@ 10,23 SAY "PLEASE INSURE THAT YOUR PRINTER"
@ 11,23 SAY "IS TURNED ON AND IN THE ONLINE"
@ 12,23 SAY "MODE"
@ 14,23 SAY "IF YOU DO NOT WISH TO PRINT"
@ 15,23 SAY "THIS RELATIONSHIP, TYPE '0' TO"
@ 16,23 SAY "RETURN TO THE PREVIOUS MENU"
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
SET DEVICE TO PRINT
SET CONSOLE OFF
DO CASE
CASE choice = 'P_PROC_E'
USE P_PROC_E
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY P_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY E_NAME
SKIP
ENDDO
CASE choice = 'S_CONT_P'
USE S_CONT_P
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
```

```
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY S_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY P_NAME
SKIP
ENDDO
CASE choice = 'P_CONT_M'
USE P_CONT_M
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY P_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY M_NAME
SKIP
ENDDO
CASE choice = 'F_CONT_R'
USE F_CONT_R
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY F_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY R_NAME
SKIP
ENDDO
ENDCASE
SET DEVICE TO SCREEN
SET CONSOLE ON
RETURN
```

```
* 122160.PRG
* MODULE NAME: 1.2.1.1.6.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.2.1.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.2.1.1.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* count    : USED TO KEEP TRACK OF THE RECORD NUMBER BEING DISPLAYED.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* option   : CONTAINS THE USER'S CHOICE ON WHETHER TO OUTPUT TO THE SCREEN
             OR THE PRINTER.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: R_CONT_E, U_RESP_S, U_RESP_F, P_PRED_D.

* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL OUTPUT THE LAST FOUR RELATIONSHIP FILES TO THE PRINTER.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
@ 0,1 SAY "1.2.1.1.6.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,27 SAY "RELATIONSHIP PRINTER OUTPUT"
@ 6,23 SAY "THIS MODULE WILL PRINT"
@ 8,24 SAY TITLE
@ 10,23 SAY "PLEASE INSURE THAT YOUR PRINTER"
@ 11,23 SAY "IS TURNED ON AND IN THE ONLINE"
@ 12,23 SAY "MODE"
@ 14,23 SAY "IF YOU DO NOT WISH TO PRINT"
@ 15,23 SAY "THIS RELATIONSHIP, TYPE '0' TO"
@ 16,23 SAY "RETURN TO THE PREVIOUS MENU"
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
SET DEVICE TO PRINT
SET CONSOLE OFF
DO CASE
CASE choice = 'R_CONT_E'
USE R_CONT_E
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY R_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY E_NAME
SKIP
ENDDO
CASE choice = 'U_RESP_S'
USE U_RESP_S
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
```

```
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY U_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY S_NAME
SKIP
ENDDO
CASE choice = 'U_RESP_F'
USE U_RESP_F
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY U_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY F_NAME
SKIP
ENDDO
CASE choice = 'P_PROD_D'
USE P_PROD_D
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,33 SAY CHOICE
@ 2,1 SAY "RECORD
"
@ 2,11 SAY count
store count + 1 to count
@ 4,1 SAY "ACCESS NAME:"
@ 4,28 SAY P_NAME
@ 5,1 SAY "IDENTIFICATION NAME:"
@ 5,28 SAY D_NAME
SKIP
ENDDO
ENDCASE
SET DEVICE TO SCREEN
SET CONSOLE ON
RETURN
```

```
* 130000.PRG
* MODULE NAME: 1.3.0.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: 1.3.1.0.0.0, 1.3.2.0.0.0, 1.3.3.0.0.0
* 1.3.4.0.0.0, 1.3.5.0.0.0, 1.3.6.0.0.0, MAIN
* LOCAL VARIABLES USED:
* choice: CONTAINS THE NUMBER OF ACTION SELECTED.
* t: REPRESTENTS NO VALUE AT ALL.
* hold: USED TO STOP ACTION FOR USER DECISION.
* name: CONTAINS THE ENTITY RELATION NAME.
* entity1: CONTAINS THE ACCESS-NAME FOR THE ENTITY RELATION BEING ?
* QUERIED.
* OUTPUT FILE: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RALATION
* AND ACCESS NAME VALUE THAT WILL BE USED IN THE QUERY
*
set color to 0/3,3
set talk off
SET EXACT ON
ERASE mem_var.mem
CLEAR
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.0.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY "ENTITY-1              RELATIONSHIP                ENTITY"
@ 5,66 SAY "-2"
@ 8,10 SAY "1)   USER"
@ 9,10 SAY "2)   SYSTEM"
@ 10,10 SAY "3)   PROGRAM"
@ 11,10 SAY "4)   MODULE"
@ 12,10 SAY "5)   DOCUMENT"
@ 13,10 SAY "6)   FILE"
@ 14,10 SAY "7)   RECORD"
@ 15,10 SAY "8)   ELEMENT"
@ 16,10 SAY "9)   RETURN TO PREVIOUS MENU"
@ 17,9 SAY "10)   RETURN TO MAIN MENU"
@ 18,4 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-10) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'USER' TO name
CASE choice = "2"
STORE 'SYSTEM' TO name
CASE choice = "3"
STORE 'PROGRAM' TO name
CASE choice = "4"
STORE 'MODULE' TO name
CASE choice = "5"
STORE 'DOCUMENT' TO name
CASE choice = "6"
STORE 'FILE' TO name
CASE choice = "7"
STORE 'RECORD' TO name
CASE choice = "8"
STORE 'ELEMENT' TO name
CASE choice = "9"
RETURN
CASE choice = "10"
RETURN TO MASTER
OTHERWISE
CLEAR
```

```
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 10 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
STORE 'N' TO correct
DO WHILE correct = 'N'
CLEAR
STORE '          ' TO entity1
@ 1,1 SAY "1.3.0.0.0.0"
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,35 SAY "QUERY MENU"
@ 6,12 SAY name
@ 6,31 SAY "RELATIONSHIP                    ENTITY-2"
@ 8,4 SAY "ENTER THE ACCESS-NAME FOR"
@ 8,31 SAY name
@ 9,4 SAY "YOU WISH TO QUERY ON"
@ 9,26 GET entity1
@ 10,4 SAY "AND PRESS RETURN"
READ
STORE 'Y' TO correct
@ 13,3 SAY "IS THIS THE ENTITY YOU WISH TO QUERY ON"
@ 13,44 SAY ENTITY1
@ 13,56 SAY "Y OR N"
@ 13,64 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
STORE 'USER' TO choice
STORE 100 TO selection
SAVE TO mem_var
do 131000
CASE choice = "2"
STORE 'SYSTEM' TO choice
STORE 200 TO selection
SAVE TO mem_var
do 132000
CASE choice = "3"
STORE 'PROGRAM' TO choice
STORE 300 TO selection
SAVE TO mem_var
do 133000
CASE choice = "4"
STORE 'MODULE' TO choice
STORE 400 TO selection
SAVE TO mem_var
do 134000
CASE choice = "5"
STORE 'DOCUMENT' TO choice
STORE 500 TO selection
SAVE TO mem_var
do 135000
CASE choice = "6"
STORE 'FILE' TO choice
STORE 600 TO selection
SAVE TO mem_var
do 136000
CASE choice = "7"
STORE 'RECORD' TO choice
STORE 700 TO selection
SAVE TO mem_var
do 137000
CASE choice = "8"
STORE 'ELEMENT' TO choice
STORE 800 TO selection
SAVE TO mem_var
```

```
do 138000
ENDCASE
```

```
* 131000.PRG
* MODULE NAME: 1.3.1.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.3.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: 1.3.1.1.0.0, 1.3.1.2.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* entity1  : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* correct  : USED AS TO HOLD USER'S CHOICE FOR LOOP TERMINATION.
* SELECTION : USED TO HOLD THE VALUE IDENTIFYING WHICH QUERY TO EXECUTE.
* INPUT FILES: MEM_VAR
* OUTPUT FILES: MEM_VAR
* mem_var.mem : USED TO TEMPORARILY STORE THE MEMORY VARIABLE VALUES.
* temp.dbf    : USED TO STORE THE RESULT OF QUERY EXECUTION.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP
* VALUE WILL BE USED IN THE QUERY
*
RESTORE FROM mem_var
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.1.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY entity1
@ 5,33 SAY "RELATIONSHIP               ENTITY-2"
@ 8,32 SAY "1)   CONTAINS"
@ 9,32 SAY "2)   IS RESPONSIBLE FOR"
@ 10,32 SAY "3)   RETURN TO PREVIOUS MENU"
@ 11,4 SAY " "
ACCEPT'          ENTER YOUR CHOICE (1-3) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'CONTAINS' TO rel_ship
CASE choice = "2"
STORE 'IS RESPONSIBLE FOR' TO rel_ship
CASE choice = "3"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
CLEAR
@ 0,1 SAY "1.3.1.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,54 SAY "ENTITY-2"
STORE 'Y' TO correct
```

```
@ 10,3 SAY "IS THIS THE RELATIONSHIP THAT"
@ 11,3 SAY "YOU WISH TO QUERY ON"
@ 11,25 SAY rel_ship
@ 12,3 SAY "Y OR N"
@ 12,11 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
STORE 'PROCESSES' TO choice
STORE selection + 10 TO selection
SAVE TO mem_var
do 131100
CASE choice = "2"
STORE 'IS RESPONSIBLE FOR' TO choice
STORE selection + 20 TO selection
SAVE TO mem_var
do 131200
ENDCASE
```

```
* 131100.PRG
* MODULE NAME: 1.3.1.1.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.1.0.0.0
* ROUTINES THAT THE MODULE CALLS: 1.3.1.0.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
* entity1  : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* entity12: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE SECOND VALUE
*            IN A QUERY STRING.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RALATION
* AND ACCESS NAME VALUE THAT WILL BE USED IN THE QUERY
*
set color to 0/3,3
set talk off
SET EXACT ON
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.1.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,34 SAY rel_ship
@ 5,60 SAY "ENTITY-2"
@ 8,54 SAY "1)   SYSTEM"
@ 9,54 SAY "2)   RETURN TO PREVIOUS"
@ 10,59 SAY "MENU"
@ 11,4 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-2) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'SYSTEM' TO entity2
CASE choice = "2"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 2 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
CLEAR
@ 0,1 SAY "1.3.1.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,59 SAY entity2
STORE 'Y' TO correct
@ 8,3 SAY "IS THIS THE ENTITY YOU WISH TO QUERY ON"
@ 8,44 SAY entity2
@ 8,56 SAY "Y OR N"
@ 8,64 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
SAVE TO mem_var
SELECT 2
USE SYSTEM
SELECT 1
USE U_PROC_S
JOIN WITH SYSTEM TO TEMP FOR U_NAME = entity1 .AND. S_NAME = ;
SYSTEM->ACC_NAME FIELDS ID_NAME, DESCRIPT
SELECT 2
USE
SELECT 1
USE
do 139000
ENDCASE
```

```
* 131200.PRG
* MODULE NAME: 1.3.1.2.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.1.0.0.0
* ROUTINES THAT THE MODULE CALLS: 1.3.1.0.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* correct  : CONTAINS USER RESPONSE AS TO WHETHER THE DISPLAYED VALUE IS
*            CORRECT OR NOT.
* entity1  : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* entity2  : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE SECOND VALUE
*            IN A QUERY STRING.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RALATIONSHIP
* THAT WILL BE USED IN THE QUERY
*
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.1.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY "ENTITY-1              RELATIONSHIP                ENTITY"
@ 5,66 SAY "-2"
@ 8,54 SAY "1)   SYSTEM"
@ 9,54 SAY "2)   FILE"
@ 10,54 SAY "3)   RETURN TO PREVIOUS"
@ 11,59 SAY "MENU"
@ 12,4 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-10) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'SYSTEM' TO name
CASE choice = "2"
STORE 'FILE' TO name
CASE choice = "3"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
CLEAR
@ 0,1 SAY "1.3.1.2.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,59 SAY name
STORE 'Y' TO correct
```

```
@ 8,3 SAY "IS THIS THE ENTITY YOU WISH TO QUERY ON"
@ 8,44 SAY name
@ 8,56 SAY "Y OR N"
@ 8,64 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
SELECT 2
USE SYSTEM
SELECT 1
USE U_RESP_S
JOIN WITH SYSTEM TO TEMP FOR U_NAME = ENTITY1 .AND. S_NAME = SYSTEM-> ACC_NAME;
FIELDS ID_NAME, DESCRIPT
SELECT 2
USE
SELECT 1
USE
DO 139000
CASE choice = "2"
SELECT 2
USE FILE
SELECT 1
USE U_RESP_F
JOIN WITH SYSTEM TO TEMP FOR U_NAME = ENTITY1 .AND. S_NAME = SYSTEM-> ACC_NAME;
FIELDS ID_NAME, DESCRIPT
SELECT 2
USE
SELECT 1
USE
DO 139000
ENDCASE
```

```
* 132000.PRG
* MODULE NAME: 1.3.2.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: MAIN
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* correct  : CONTAINS USER RESPONSE AS TO WHETHER THE DISPLAYED VALUE IS
*            CORRECT OR NOT.
* entity1  : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RALATIONSHIP
* THAT WILL BE USED IN THE QUERY
*
set color to 0/3,3
set talk off
SET EXACT ON
RESTORE FROM mem_var
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.2.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY entity1
@ 5,33 SAY "RELATIONSHIP               ENTITY-2"
@ 7,29 SAY "1)   PROCESSES"
@ 9,29 SAY "2)   IS PROCESSED BY"
@ 11,29 SAY "3)   CONTAINS"
@ 13,29 SAY "4)   RETURN TO PREVIOUS MENU"
@ 14,4 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-4) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'PROCESSES' TO rel_ship
CASE choice = "2"
STORE 'IS PROCESSED BY' TO rel_ship
CASE choice = "3"
STORE 'CONTAINS' TO rel_ship
CASE choice = "4"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 4 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
CLEAR
@ 0,1 SAY "1.3.2.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,58 SAY "ENTITY-2"
@ 7,4 SAY "IS THIS THE RELATIONSHIP"
@ 8,4 SAY "THAT YOU WISH TO QUERY ON"
@ 8,31 SAY rel_ship
@ 9,4 SAY "Y OR N"
@ 9,12 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
STORE selection + 10 TO selection
SAVE TO mem_var
do 132100
CASE choice = "2"
STORE selection + 20 TO selection
SAVE TO mem_var
do 132200
CASE choice = "3"
STORE selection + 30 TO selection
SAVE TO mem_var
do 132300
ENDCASE
```

```
* 133000.PRG
* MODULE NAME: 1.3.3.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: MAIN
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* correct : CONTAINS USER RESPONSE AS TO WHETHER THE DISPLAYED VALUE IS
*            CORRECT OR NOT.
* entity1 : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RALATION
* AND ACCESS NAME VALUE THAT WILL BE USED IN THE QUERY
*
RESTORE FROM mem_var
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.3.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY entity1
@ 5,33 SAY "RELATIONSHIP                ENTITY-2"
@ 7,28 SAY "1)   PROCESSES"
@ 9,28 SAY "2)   IS PROCESSED BY"
@ 11,28 SAY "3)   CONTAINS"
@ 13,28 SAY "4)   PRODUCES"
@ 15,28 SAY "5)   IS THE RESPONISBILITY OF"
@ 17,28 SAY "6)   IS CONTAINED IN"
@ 19,28 SAY "7)   RETURN TO PREVIOUS MENU"
@ 20,4 SAY " "
ACCEPT'          ENTER YOUR CHOICE (1-7) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'PROCESSES' TO rel_ship
CASE choice = "2"
STORE 'IS PROCESSED BY' TO rel_ship
CASE choice = "3"
STORE 'CONTAINS' TO rel_ship
CASE choice = "4"
STORE 'PRODUCES' TO rel_ship
CASE choice = "5"
STORE 'IS THE RESPONSIBILITY OF' TO rel_ship
CASE choice = "6"
STORE 'IS CONTAINED IN' TO rel_ship
CASE choice = "7"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 7 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
```

```
ENDDO
CLEAR
@ 0,1 SAY "1.3.3.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,58 SAY "ENTITY-2"
@ 7,4 SAY "IS THIS THE RELATIONSHIP"
@ 8,4 SAY "THAT YOU WISH TO QUERY ON"
@ 8,31 SAY rel_ship
@ 9,4 SAY "Y OR N"
@ 9,12 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
STORE selection + 10 TO selection
SAVE TO mem_var
do 133100
CASE choice = "2"
STORE selection + 20 TO selection
SAVE TO mem_var
do 133200
CASE choice = "3"
STORE selection + 30 TO selection
SAVE TO mem_var
do 133300
CASE choice = "4"
STORE selection + 40 TO selection
SAVE TO mem_var
do 133400
CASE choice = "5"
STORE selection + 50 TO selection
SAVE TO mem_var
do 133500
CASE choice = "6"
STORE selection + 60 TO selection
SAVE TO mem_var
do 133600
ENDCASE
```

```
* 134000.PRG
* MODULE NAME: 1.3.4.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: MAIN
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* correct : CONTAINS USER RESPONSE AS TO WHETHER THE DISPLAYED VALUE IS
*            CORRECT OR NOT.
* entity1 : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
*
RESTORE FROM mem_var
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.4.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY entity1
@ 5,33 SAY "RELATIONSHIP               ENTITY-2"
@ 7,29 SAY "1)   IS CONTAINED IN"
@ 9,29 SAY "2)   IS PROCESSED BY"
@ 11,29 SAY "3)   IS THE RESPONSIBILITY OF"
@ 13,29 SAY "4)   RETURN TO PREVIOUS MENU"
@ 14,4 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-4) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'IS CONTAINED IN' TO rel_ship
CASE choice = "2"
STORE 'IS PRODESSED BY' TO rel_ship
CASE choice = "3"
STORE 'IS THE RESPONSIBILITY OF' TO rel_ship
CASE choice = "4"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 4 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
CLEAR
@ 0,1 SAY "1.3.4.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,58 SAY "ENTITY-2"
@ 7,4 SAY "IS THIS THE RELATIONSHIP"
@ 8,4 SAY "THAT YOU WISH TO QUERY ON"
@ 8,31 SAY rel_ship
@ 9,4 SAY "Y OR N"
@ 9,12 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
STORE selection + 10 TO selection
SAVE TO mem_var
do 134100
CASE choice = "2"
STORE selection + 20 TO selection
SAVE TO mem_var
do 134200
CASE choice = "3"
STORE selection + 30 TO selection
SAVE TO mem_var
do 134300
ENDCASE
```

```
* 135000.PRG
* MODULE NAME: 1.3.5.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: MAIN
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* correct : CONTAINS USER RESPONSE AS TO WHETHER THE DISPLAYED VALUE IS
*            CORRECT OR NOT.
* entity1 : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
set color to 0/3,3
set talk off
SET EXACT ON
RESTORE FROM mem_var
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.5.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY entity1
@ 5,33 SAY "RELATIONSHIP              ENTITY-2"
@ 8,28 SAY "1)   IS PRODUCED BY"
@ 10,28 SAY "2)   RETURN TO PREVIOUS MENU"
@ 11,4 SAY " "
ACCEPT'          ENTER YOUR CHOICE (1-2) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'IS PRODUCED BY' TO rel_ship
CASE choice = "2"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 2 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
CLEAR
@ 0,1 SAY "1.3.5.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,58 SAY "ENTITY-2"
@ 7,4 SAY "IS THIS THE RELATIONSHIP"
@ 8,4 SAY "THAT YOU WISH TO QUERY ON"
@ 8,31 SAY rel_ship
@ 9,4 SAY "Y OR N"
@ 9,12 GET correct
READ
ENDDO
DO CASE
```

```
CASE choice = "1"
STORE selection + 10 TO selection
SAVE TO mem_var
do 135100
ENDCASE
```

```
* 136000.PRG
* MODULE NAME: 1.3.6.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: MAIN
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* correct  : CONTAINS USER RESPONSE AS TO WHETHER THE DISPLAYED VALUE IS
*            CORRECT OR NOT.
* entity1  : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
*
RESTORE FROM mem_var
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.6.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY entity1
@ 5,33 SAY "RELATIONSHIP                ENTITY-2"
@ 7,28 SAY "1)   CONTAINS"
@ 9,28 SAY "2)   IS PROCESSED BY"
@ 11,28 SAY "3)   IS THE RESPONSIBILITY OF"
@ 13,28 SAY "4)   RETURN TO PREVIOUS MENU"
@ 14,4 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-4) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'CONTAINS' TO rel_ship
CASE choice = "2"
STORE 'IS PROCESSED BY' TO rel_ship
CASE choice = "3"
STORE 'IS THE RESPONSIBILITY OF' TO rel_ship
CASE choice = "4"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 4 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
CLEAR
@ 0,1 SAY "1.3.6.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,58 SAY "ENTITY-2"
@ 7,4 SAY "IS THIS THE RELATIONSHIP"
@ 8,4 SAY "THAT YOU WISH TO QUERY ON"
@ 8,31 SAY rel_ship
@ 9,4 SAY "Y OR N"
@ 9,12 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
STORE selection + 10 TO selection
SAVE TO mem_var
do 136100
CASE choice = "2"
STORE selection + 20 TO selection
SAVE TO mem_var
do 136200
CASE choice = "3"
STORE selection + 30 TO selection
SAVE TO mem_var
do 136300
ENDCASE
```

```
* 137000.PRG
* MODULE NAME: 1.3.7.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: MAIN
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* correct : CONTAINS USER RESPONSE AS TO WHETHER THE DISPLAYED VALUE IS
*            CORRECT OR NOT.
* entity1 : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
*
RESTORE FROM mem_var
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.7.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY entity1
@ 5,33 SAY "RELATIONSHIP                ENTITY-2"
@ 7,27 SAY "1)   CONTAINS"
@ 9,27 SAY "2)   IS CONTAINED IN"
@ 11,27 SAY "3)   IS PROCESSED BY"
@ 13,27 SAY "4)   IS THE RESPONSIBILITY OF"
@ 15,27 SAY "5)   RETURN TO PREVIOUS MENU"
@ 16,1 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-5) FROM ABOVE:'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'CONTAINS' TO rel_ship
CASE choice = "2"
STORE 'IS CONTAINED IN' TO rel_ship
CASE choice = "3"
STORE 'IS PROCESSED BY' TO rel_ship
CASE choice = "4"
STORE 'IS THE RESPONSIBILITY OF' TO rel_ship
CASE choice = "5"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 5 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
CLEAR
@ 0,1 SAY "1.3.7.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,58 SAY "ENTITY-2"
@ 7,4 SAY "IS THIS THE RELATIONSHIP"
@ 8,4 SAY "THAT YOU WISH TO QUERY ON"
@ 8,31 SAY rel_ship
@ 9,4 SAY "Y OR N"
@ 9,12 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
STORE selection + 10 TO selection
SAVE TO mem_var
do 137100
CASE choice = "2"
STORE selection + 20 TO selection
SAVE TO mem_var
do 137200
CASE choice = "3"
STORE selection + 30 TO selection
SAVE TO mem_var
do 137300
CASE choice = "4"
STORE selection + 40 TO selection
SAVE TO mem_var
do 137400
ENDCASE
```

```
* 138000.PRG
* MODULE NAME: 1.3.8.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: MAIN
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* correct : CONTAINS USER RESPONSE AS TO WHETHER THE DISPLAYED VALUE IS
*            CORRECT OR NOT.
? entity? ? CONTAIN? TH? CHARACTE? STRIN? THA? REPRESENT? TH? FIRS? VALUE
*            IN A QUERY STRING.
? entity2 ? CONTAIN? TH? CHARACTE? STRIN? THA? REPRESENT? TH? SECOND VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
*
RESTORE FROM mem_var
ERASE mem_var.mem
CLEAR
STORE 'N' TO correct
DO WHILE correct = 'N'
STORE .t. TO true
do while true
CLEAR
@ 0,1 SAY "1.3.8.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,11 SAY entity1
@ 5,33 SAY "RELATIONSHIP               ENTITY-2"
@ 7,27 SAY "1)   IS CONTAINED IN"
@ 9,27 SAY "2)   IS PROCESSED BY"
@ 11,27 SAY "3)   IS THE RESPONSIBILITY OF"
@ 13,27 SAY "4)   RETURN TO THE PREVIOUS MENU"
@ 14,4 SAY " "
ACCEPT'          ENTER YOUR CHOICE (1-4) FROM ABOVE: 'TO choice
STORE .f. TO true
DO CASE
CASE choice = "1"
STORE 'IS CONTAINED IN' TO rel_ship
CASE choice = "2"
STORE 'IS PROCESSED BY' TO rel_ship
CASE choice = "3"
STORE 'IS THE RESPONSIBILITY OF' TO rel_ship
CASE choice = "4"
RETURN
OTHERWISE
CLEAR
@ 2,14 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 4 ONLY"
@ 3,14 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
STORE .t. TO true
ENDCASE
ENDDO
CLEAR
@ 0,1 SAY "1.3.8.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,35 SAY "QUERY MENU"
@ 5,12 SAY entity1
@ 5,32 SAY rel_ship
@ 5,58 SAY "ENTITY-2"
@ 7,4 SAY "IS THIS THE RELATIONSHIP"
@ 8,4 SAY "THAT YOU WISH TO QUERY ON"
@ 8,31 SAY rel_ship
@ 9,4 SAY "Y OR N"
@ 9,12 GET correct
READ
ENDDO
DO CASE
CASE choice = "1"
STORE selection + 10 TO selection
SAVE TO mem_var
do 138100
CASE choice = "2"
STORE selection + 20 TO selection
SAVE TO mem_var
do 138200
CASE choice = "3"
STORE selection + 30 TO selection
SAVE TO mem_var
do 138300
ENDCASE
```

```
* 139000.PRG
* MODULE NAME: 1.3.9.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.1.1.0.0  THRU 1.3.8.3.0.0
* ROUTINES THAT THE MODULE CALLS:1.3.1.1.0.0  THRU 1.3.8.3.0.0
* LOCAL VARIABLES USED:
* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*           CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* true    : USED AS A BOOLEAN VALUE IN LOOPS.
* option  : USED TO HOLD THE VALUE REPRESENTING THE CHOICE OF PRINTER OR
*           SCREEN OUTPUT.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHETHER THE OUTPUT WILL BE
* DISPLAYED ON THE SCREEN OR PRINTED.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
STORE .t. TO TRUE
do while TRUE
CLEAR
@ 0,1 SAY "1.3.9.0.0.0"
RESTORE FROM mem_var
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,34 SAY "QUERY OUTPUT"
@ 8,23 SAY "LISTED BELOW ARE THE CHOICES FOR HOW"
@ 9,23 SAY "YOU CAN HAVE THE QUERY"
@ 11,24 SAY entity1
@ 11,38 SAY rel_ship
@ 11,57 SAY entity2
@ 13,23 SAY "DISPLAYED."
@ 15,28 SAY "1)  SCREEN OUTPUT"
@ 17,28 SAY "2)  PRINTER OUPUT"
@ 19,28 SAY "3)  RETURN TO PREVIOUS MENU"
@ 20,1 SAY " "
ACCEPT'          ENTER YOUR CHOICE (1-3) FROM ABOVE 'TO option
ERASE mem_var.mem
SAVE TO mem_var
DO CASE
CASE option = '1'
DO 139100
CASE option = '2'
DO 139200
CASE option = '3'
RETURN
OTHERWISE
CLEAR
@ 0,27 SAY option
@ 0,34 SAY "IS NOT A VALID CHOICE"
@ 1,26 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
@ 2,26 SAY "PRESS RETURN AND TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
```

```
* 139100.PRG
* MODULE NAME: 1.3.9.1.0.0
* ROUTINES THAT CALL THE MODLUE: 1.3.9.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.3.9.0.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* option   : CONTAINS THE USER'S CHOICE ON WHETHER TO OUTPUT TO THE SCREEN
*             OR THE PRINTER.
* stop     : USED TO STOP ACTION FOR USER DECISION.
* t        : REPRESTENTS THE BOOLEAN TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* entity1 : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* entity2 : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE SECOND VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE WILL DISPLAY THE RESULTS OF THE QUERY ON THE SCREEN.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL DISPLAY THE RESULTS OF THE QUERY
* ON THE SCREEN.
* PROGRAM AND MODULE RELATIONS
*
RESTORE FROM mem_var
CLEAR
@ 0,1 SAY "1.3.9.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,30 SAY "QUERY SCREEN OUTPUT"
@ 5,22 SAY "THIS MODULE WILL DISPLAY THE RESULTS OF"
@ 7,21 SAY entity1
@ 7,38 SAY rel_ship
@ 7,59 SAY entity2
@ 9,22 SAY "IF YOU DO NOT WISH TO DISPLAY THIS RELATION,"
@ 10,22 SAY "TYPE '0' TO RETURN TO THE PREVIOUS MENU."
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
CLEAR
USE TEMP
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
CLEAR
@ 0,1 SAY "1.3.9.1.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,32 SAY "QUERY RESULTS FOR"
@ 5,21 SAY entity1
@ 5,38 SAY rel_ship
@ 5,59 SAY entity2
USE TEMP
STORE 1 TO count
SET HEADING OFF
DO WHILE .NOT. EOF()
@ 7,1 SAY "RECORD #"
@ 7,9 SAY count
@ 9,1 SAY " "
store count + 1 to count
@ 10,4 SAY "IDENTIFICATION NAME:"
@ 10,31 SAY ID_NAME
@ 12,4 SAY "DESCRIPTION:"
@ 12,21 SAY descript
@ 17,4 SAY " "
WAIT TO hold
SKIP
ENDDO
RETURN
```

```
* 139200.PRG
* MODULE NAME: 1.3.9.2.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.3.9.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.3.9.0.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO;
*            MODIFIED, DELETED FROM OR OUTPUT.
* correct  : CONTAINS USER RESPONSE AS TO WHETHER THE DISPLAYED VALUE IS
*            CORRECT OR NOT.
* entity1  : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE FIRST VALUE
*            IN A QUERY STRING.
* entity2  : CONTAINS THE CHARACTER STRING THAT REPRESENTS THE SECOND VALUE
*            IN A QUERY STRING.
* rel_ship: CONTAINS THE CHARACTER STRING THAT REPRESENTS THE RELATIONSHIP
*            VALUE IN A QUERY STRING.
* true     : USED AS A BOOLEAN VALUE IN LOOPS.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL OUTPUT THE QUERY TO THE PRINTER.
*
SET EXACT ON
set color to 0/3,3
set talk off
set menu on
SET EXACT ON
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
@ 0,1 SAY "1.3.9.2.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,29 SAY "QUERY PRINTER OUTPUT"
@ 6,23 SAY "THIS MODULE WILL PRINT QUERY"
@ 8,20 SAY entity1
@ 8,37 SAY rel_ship
@ 8,56 SAY name
@ 10,23 SAY "PLEASE INSURE THAT YOUR PRINTER"
@ 11,23 SAY "IS TURNED ON AND IN THE ONLINE"
@ 12,23 SAY "MODE"
@ 14,23 SAY "IF YOU DO NOT WISH TO PRINT"
@ 15,23 SAY "THIS RELATION, TYPE '0' TO"
@ 16,23 SAY "RETURN TO THE PREVIOUS MENU"
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
SET DEVICE TO PRINT
SET CONSOLE OFF
USE TEMP
STORE 1 TO count
DO WHILE .NOT. EOF()
@ 29,1 SAY "1.3.9.2.0.0"
@ 30,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 32,32 SAY "RESULTS FOR QUERY"
@ 34,20 SAY entity1
@ 34,37 SAY rel_ship
@ 34,56 SAY name
@ 40,1 SAY "RECORD #"
@ 40,11 SAY count
```

```
store count + 1 to count
@ 42,3 SAY "IDENTIFICATION NAME:"
@ 42,30 SAY ID_NAME
@ 44,3 SAY "DESCRIPTION:"
@ 44,19 SAY descript
SKIP
ENDDO
SET DEVICE TO SCREEN
SET CONSOLE ON
RETURN
```

```
* 140000.PRG
* MODULE NAME: 1.4.0.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: MAIN
* ROUTINES THAT THE MODULE CALLS:1.1.1.0.0.0, 1.1.2.0.0.0, 1.1.3.0.0.0,
* 1.1.4.0.0.0, 1.1.5.0.0.0, MAIN.
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS FOR THE MAINTENANCE OF ENTITY SCHEMA,
* AND RELATIONSHIP SCHEMA.
*
do while .t.
CLEAR
@ 0,1 SAY "1.4.0.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,31 SAY "MAINTENANCE  MENU"
@ 6,22 SAY "1)   MODIFY ENTITY SCHEMA"
@ 8,22 SAY "2)   MODIFY RELATIONSHIP SCHEMA"
@ 10,22 SAY "3)   RETURN TO MAIN MENU"
@ 11,1 SAY " "
ACCEPT '         ENTER YOUR CHOICE (1-3) FROM ABOVE: ' TO choice
DO CASE
CASE choice = "1"
do 141000
CASE choice = "2"
DO 142000
CASE choice = "3"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 2,20 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
@ 3,20 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 141000.PRG
* MODULE NAME: 1.4.1.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.4.0.0.0.0
* ROUTINES THAT THE MODULE CALLS: MAIN
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                         t: REPRESTENTS NO VALUE AT ALL.
*                         hold: USED TO STOP ACTION FOR USER DECISION.
* INPUT FILES: MEM_VAR, USER, SYSTEM, PROGRAM, MODULE, DOCUMENT, FILE, RECORD,
*              ELEMENT.
* OUTPUT FILES: MEM_VAR, USER, SYSTEM, PROGRAM, MODULE, DOCUMENT, FILE, RECORD,
*               ELEMENT
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RELATION
* TO MODIFY.
*
do while .t.
CLEAR
@ 0,1 SAY "1.4.1.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,31 SAY "MODIFY ENTITY SCHEMA"
@ 6,15 SAY "1)   USER                6)   FILE"
@ 8,15 SAY "2)   SYSTEM              7)   RECORD"
@ 10,15 SAY "3)   PROGRAM             8)   ELEMENT"
@ 12,15 SAY "4)   MODULE              9)   RETURN TO PREVIOUS MENU"
@ 14,15 SAY "5)   DOCUMENT           10)   RETURN TO MAIN MENU"
@ 16,1 SAY " "
ACCEPT'          ENTER YOUR CHOICE (1-10) FROM ABOVE: 'TO choice
DO CASE
CASE choice = "1"
USE USER
MODIFY STRUCTURE
CASE choice = "2"
USE SYSTEM
MODIFY STRUCTURE
CASE choice = "3"
USE PROGRAM
MODIFY STRUCTURE
CASE choice = "4"
USE MODULE
MODIFY STRUCTURE
CASE choice = "5"
USE DOCUMENT
```

```
MODIFY STRUCTURE
CASE choice = "6"
USE FILE
MODIFY STRUCTURE
CASE choice = "7"
USE RECORD
MODIFY STRUCTURE
CASE choice = "8"
USE ELEMENT
MODIFY STRUCTURE
CASE choice = "9"
RETURN
CASE choice = "10"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 2,20 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 10 ONLY"
@ 3,20 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 142000.PRG
* MODULE NAME: 1.4.2.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.4.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.4.0.0.0.0, MAIN
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* INPUT FILES: MEM_VAR , U_CONTS, U_CONT_S,
*               U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PRED_D.
* OUTPUT FILES: MEM_VAR, ELEMENT, U_CONTS, U_CONT_S,
*               U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PRED_D.

* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH RELATIONSHIP
* SCHEMA HE WOULD LIKE TO MODISY.
*
do while .t.
CLEAR
SET MENU ON
@ 1,1 SAY "1.4.2.0.0.0"
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,25 SAY "RELATIONSHIP SCHEMA MAINTENANCE"
@ 6,9 SAY "1)   USER CONTAINS SYSTEM        8)   FILE CONTAINS REC"
@ 6,64 SAY "ORDS"
@ 8,9 SAY "2)   SYSTEM CONTAINS PROGRAM     9)   RECORD CONTAINS E"
@ 8,64 SAY "LEMENT"
@ 10,9 SAY "3)   PROGRAM PROCESSES FILE     10)   USER RESPONSIBLE"
@ 10,64 SAY "FOR SYSTEM"
@ 12,9 SAY "4)   PROGRAM PROCESSES RECORD   11)   USER RESPONSIBLE"
@ 12,64 SAY "FOR FILE"
@ 14,9 SAY "5)   PROGRAM PROCESSES ELEMENT  12)   PROGRAM PRODUCES"
@ 14,64 SAY "DOCUMENT"
@ 16,9 SAY "6)   SYSTEM CONTAINS PROGRAM    13)   RETURN TO PREVIOU"
@ 16,64 SAY "S MENU"
@ 18,9 SAY "7)   PROGRAM CONTAINS MODULE    14)   RETURN TO MAIN ME"
@ 18,64 SAY "NU"
@ 19,1 SAY " "
ACCEPT '         ENTER YOUR CHOICE (1-10) FROM ABOVE: ' TO choice
DO CASE
CASE choice = "1"
```

```
USE U_PROC_S
MODIFY STRUCTURE
CASE choice = "2"
USE S_PROC_P
MODIFY STRUCTURE
CASE choice = "3"
USE P_PROC_F
MODIFY STRUCTURE
CASE choice = "4"
USE P_PROC_R
MODIFY STRUCTURE
CASE choice = "5"
USE P_PROC_E
MODIFY STRUCTURE
CASE choice = "6"
USE S_CONT_P
MODIFY STRUCTURE
CASE choice = "7"
USE P_CONT_M
MODIFY STRUCTURE
CASE choice = "8"
USE F_CONT_R
MODIFY STRUCTURE
CASE choice = "9"
USE R_CONT_E
MODIFY STRUCTURE
CASE choice = "10"
USE U_RESP_S
MODIFY STRUCTURE
CASE choice = "11"
USE U_RESP_F
MODIFY STRUCTURE
CASE choice = "12"
USE P_PROD_D
MODIFY STRUCTURE
CASE choice = "13"
RETURN
CASE choice = "14"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 1,21 SAY choice
@ 1,28 SAY "IS NOT A VALID CHOICE"
@ 2,20 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 14 ONLY"
@ 3,20 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
```

```
ENDCASE
ENDDO
RETURN
```

```
* 150000.prg
* MODULE NAME: 1.5.0.0.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: MAIN
* ROUTINES THAT THE MODULE CALLS: MAIN.
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS PROGRAM ALLOWS FOR THE THE SELECTION OF WHICH TYPE OF
* SCHEMA WILL BE OUTPUT.
*
do while .t.
CLEAR
@ 0,1 SAY "1.5.0.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,34 SAY "SCHEMA OUTPUT"
@ 6,22 SAY "1)   ENTITY"
@ 8,22 SAY "2)   RELATIONSHIP"
@ 10,22 SAY "3)   RETURN TO MAIN MENU"
@ 11,22 SAY " "
ACCEPT '         ENTER YOUR CHOICE (1-3) FROM ABOVE: 'TO choice
DO CASE
CASE choice = "1"
do 151000
CASE choice = "2"
DO 152000
CASE choice = "3"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 2,20 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
@ 3,20 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 121000.PRG
* MODULE NAME: 1.5.1.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.5.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.5.0.0.0.0, 1.5.1.1.0.0 MAIN
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF ENTITY RELATION
* TO OUTPUT.
*
SET EXACT ON
set color to 0/3,3
set talk off
CLEAR
do while .t.
ERASE mem_var.mem
CLEAR
@ 0,1 SAY "1.5.1.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,29 SAY " ENTITY SCHEMA OUTPUT"
@ 6,15 SAY "1)   USER                6)   FILE"
@ 8,15 SAY "2)   SYSTEM              7)   RECORD"
@ 10,15 SAY "3)   PROGRAM             8)   ELEMENT"
@ 12,15 SAY "4)   MODULE              9)   RETURN TO PREVIOUS MENU"
@ 14,15 SAY "5)   DOCUMENT           10)   RETURN TO MAIN MENU"
@ 15,1 SAY " "
ACCEPT'          ENTER YOUR CHOICE (1-10) FROM ABOVE: 'TO choice
DO CASE
CASE choice = "1"
store 'USER' to choice
save to mem_var
do 151100
CASE choice = "2"
store 'SYSTEM' to choice
save to mem_var
DO 151100
CASE choice = "3"
store 'PROGRAM' to choice
save to mem_var
```

```
DO 151100
CASE choice = "4"
store 'MODULE' to choice
save to mem_var
DO 151100
CASE choice = "5"
store 'DOCUMENT' to choice
save to mem_var
DO 151100
CASE choice = "6"
store 'FILE' to choice
save to mem_var
DO 151100
CASE choice = "7"
store 'RECORD' to choice
save to mem_var
DO 151100
CASE choice = "8"
store 'ELEMENT' to choice
save to mem_var
DO 151100
CASE choice = "9"
RETURN
CASE choice = "10"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 1,23 SAY choice
@ 1,31 SAY "IS NOT A VALID CHOICE"
@ 2,18 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 10 ONLY"
@ 3,18 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 151100.PRG
* MODULE NAME: 1.5.1.1.0.0
* INPUT FILES: NONE
* OUTPUT FILES: NONE
* ROUTINES THAT CALL THE MODLUE: 1.5.1.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.5.1.0.0.0
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
*                       count: KEEPS TRACK OF ACCOUNT NUMBERS.
*                       option: USED TO SELECT PRINTER OR SCREEN.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHETHER THE OUTPUT WILL BE
* DISPLAYED ON THE SCREEN OR PRINTED.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
STORE .t. TO TRUE
do while TRUE
CLEAR
@ 0,1 SAY "1.5.1.1.0.0"
RESTORE FROM mem_var
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,29 SAY "ENTITY SCHEMA OUTPUT"
@ 8,23 SAY "LISTED BELOW ARE THE CHOICES FOR HOW"
@ 9,23 SAY "YOU CAN HAVE THE RELATION"
@ 9,50 SAY CHOICE
@ 10,23 SAY "DISPLAYED."
@ 12,28 SAY "1)  SCREEN OUTPUT"
@ 14,28 SAY "2)  PRINTER OUPUT"
@ 16,28 SAY "3)  RETURN TO PREVIOUS MENU"
@ 17,1 SAY " "
ACCEPT'          ENTER YOUR CHOICE (1-3) FROM ABOVE 'TO option
ERASE mem_var.mem
SAVE TO mem_var
DO CASE
CASE option = '1'
DO CASE
CASE CHOICE = 'USER'
```

```
DO 151110
CASE choice = 'SYSTEM'
DO 151110
CASE CHOICE = 'PROGRAM'
DO 151110
CASE choice = 'MODULE'
DO 151110
CASE CHOICE = 'DOUCMENT'
DO 151110
CASE choice = 'FILE'
DO 151110
CASE CHOICE = 'RECORD'
DO 151110
CASE choice = 'ELEMENT'
DO 151110
ENDCASE
CASE option = '2'
DO CASE
CASE CHOICE = 'USER'
DO 151120
CASE choice = 'SYSTEM'
DO 151120
CASE CHOICE = 'PROGRAM'
DO 151120
CASE choice = 'MODULE'
DO 151120
CASE CHOICE = 'DOUCMENT'
DO 151120
CASE choice = 'FILE'
DO 151120
CASE CHOICE = 'RECORD'
DO 151120
CASE choice = 'ELEMENT'
DO 151120
ENDCASE
CASE option = '3'
RETURN
OTHERWISE
CLEAR
@ 0,27 SAY option
@ 0,34 SAY "IS NOT A VALID CHOICE"
@ 1,26 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
WAIT TO stop
ENDCASE
ENDDO
```

```
* 151110.PRG
* MODULE NAME: 1.5.1.1.1.0
* ROUTINES THAT CALL THE MODLUE: 1.5.1.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.5.1.1.0.0
* LOCAL VARIABLES USED:
* choice  : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*           CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*           MODIFIED, DELETED FROM OR OUTPUT.
* count   : USED TO KEEP TRACK OF THE RECORD NUMBER BEING DISPLAYED.
* stop    : USED TO STOP ACTION FOR USER DECISION.
* t       : REPRESTENTS THE BOOLEAN FALUE TRUE IS USED TO CREATE A CONTINUES
*           LOOP.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL DISPLAY ON THE SCREEN ENTITY RELATION SCHEMA.
*
SET EXACT ON
set color to 0/3,3
set talk off
set menu on
SET EXACT ON
RESTORE FROM mem_var
CLEAR
@ 0,1 SAY "1.5.1.1.1.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,26 SAY " ENTITY SCHEMA SCREEN OUTPUT"
@ 5,22 SAY "THIS MODULE WILL DISPLAY"
@ 5,48 SAY choice
@ 7,22 SAY "IF YOU DO NOT WISH TO DISPLAY"
@ 8,22 SAY "THIS SCHEMA, TYPE '0' TO"
@ 9,22 SAY "RETURN TO THE PREVIOUS MENU."
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
@ 1,1 SAY "1.5.1.1.1.0"
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,30 SAY "RELATION SCHEMA FOR"
@ 6,37 SAY choice
```

```
2 9,1 " "
DO CASE
CASE choice = 'USER'
CLEAR
USE USER
DISPLAY STRUCTURE
WAIT TO stop
RETURN
CASE choice = 'SYSTEM'
CLEAR
USE SYSTEM
DISPLAY STRUCTURE
WAIT TO stop
RETURN
CASE choice = 'PROGRAM'
CLEAR
USE PROGRAM
DISPALY STRUCTURE
WAIT TO stop
RETURN
CASE choice = 'MODULE'
CLEAR
USE MODULE
DISPLAY STRUCTURE
WAIT TO stop
RETURN
CASE choice = 'DOCUMENT'
CLEAR
USE DOCUMENT
DISPLAY STRUCTURE
WAIT TO stop
RETURN
CASE choice = 'FILE'
CLEAR
USE FILE
DISPLAY STRUCTURE
WAIT TO stop
RETURN
CASE choice = 'RECORD'
CLEAR
USE RECORD
DISPALY STRUCTURE
WAIT TO stop
RETURN
CASE choice = 'ELEMENT'
CLEAR
```

```
USE ELEMENT
DISPLAY STRUCTURE
WAIT TO stop
RETURN
ENDCASE
```

```
* 151120.PRG
* MODULE NAME: 1.5.1.1.2.0
* ROUTINES THAT CALL THE MODLUE: 1.5.1.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.5.1.1.0.0
* LOCAL VARIABLES USED:
* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* count    : USED TO KEEP TRACK OF THE RECORD NUMBER BEING DISPLAYED.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* option   : CONTAINS THE USER'S CHOICE ON WHETHER TO OUTPUT TO THE SCREEN
*            OR THE PRINTER.
* t        : REPRESENTS THE BOOLEAN FALUE TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* INPUT FILES: MEM_VAR, USER, SYSTEM, PROGRAM, MODULE, DOCUMENT, FILE, RECORD,
*              ELEMENT.
* OUTPUT FILES: MEM_VAR USER, SYSTEM, PROGRAM, MODULE, DOCUMENT, FILE, RECORD,
*               ELEMENT.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL OUTPUT THE USER, SYSTEM, PROGRAM AND MODULE
* RELATION FILES TO THE PRINTER.
*
SET EXACT ON
set color to 0/3,3
set talk off
set menu on
SET EXACT ON
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
@ 0,1 SAY "1.5.1.1.2.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,27 SAY "ENTITY SCHEMA PRINTER OUTPUT"
@ 5,23 SAY "THIS MODULE WILL PRINT"
@ 5,47 SAY choice
@ 7,23 SAY "PLEASE INSURE THAT YOUR PRINTER"
@ 8,23 SAY "IS TURNED ON AND IN THE ONLINE"
@ 9,23 SAY "MODE"
@ 11,23 SAY "IF YOU DO NOT WISH TO PRINT"
@ 12,23 SAY "THIS SCHEMA, TYPE '0' TO"
@ 13,23 SAY "RETURN TO THE PREVIOUS MENU"
WAIT TO stop
```

```
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
SET DEVICE TO PRINT
SET CONSOLE OFF
@ 1,1 SAY "1.5.1.1.2.0"
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,31 SAY "RELATION SCHEMA FOR"
@ 6,35 SAY choice
@ 8,1  SAY " "
DO CASE
CASE choice = 'USER'
USE USER
DISPLAY STRUCTURE TO PRINT
CASE choice = 'SYSTEM'
USE SYSTEM
DISPLAY STRUCTURE TO PRINT
CASE choice = 'PROGRAM'
USE PROGRAM
DISPLAY STRUCTURE TO PRINT
CASE choice = 'MODULE'
USE MODULE
DISPLAY STRUCTURE TO PRINT
CASE choice = 'DOCUMENT'
USE DOCUMENT
DISPLAY STRUCTURE TO PRINT
CASE choice = 'FILE'
USE FILE
DISPLAY STRUCTURE TO PRINT
CASE choice = 'RECORD'
USE RECORD
DISPLAY STRUCTURE TO PRINT
CASE choice = 'ELEMENT'
USE ELEMENT
DISPLAY STRUCTURE TO PRINT
ENDCASE
SET DEVICE TO SCREEN
SET CONSOLE ON
RETURN
```

```
* 152000.PRG
* MODULE NAME: 1.5.2.0.0.0
* ROUTINES THAT CALL THE MODLUE: 1.1.0.0.0.0
* ROUTINES THAT THE MODULE CALLS:TBD, MAIN

* LOCAL VARIABLES USED:

* choice   : CONTAINS THE NUMBER OF ACTION SELECTED. MAY ALSO CONTAIN THE
*            CHARACTER STRING THAT IDENTIFIES THE RELATION BEING ADDED TO,
*            MODIFIED, DELETED FROM OR OUTPUT.
* hold     : USED TO STOP ACTION FOR USER DECISION.
* t        : REPRESTENTS THE BOOLEAN FALUE TRUE IS USED TO CREATE A CONTINUES
*            LOOP.
* title    : CONTAINS THE CHARACTER STRING THAT DESCRIBES THE RELATIONSHIP
*            BEING ADDED TO, DELETED FROM OR OUTPUT.
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH RELATIONSHIP HE WOULD
* LIKE TO DISPLAY THE SCHEMA OF.
*
SET EXACT ON
set color to 0/3,3
set talk off
CLEAR
do while .t.
ERASE mem_var.mem
CLEAR
@ 0,1 SAY "1.5.2.0.0.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,27 SAY "RELATIONSHIP SCHEMA OUTPUT"
@ 5,9 SAY "1)   USER CONTAINS SYSTEM        8)   FILE CONTAINS REC"
@ 5,64 SAY "ORDS"
@ 7,9 SAY "2)   SYSTEM CONTAINS PROGRAM     9)   RECORD CONTAINS E"
@ 7,64 SAY "LEMENT"
@ 9,9 SAY "3)   PROGRAM PROCESSES FILE     10)   USER RESPONSIBLE"
@ 9,64 SAY "FOR SYSTEM"
@ 11,9 SAY "4)   PROGRAM PROCESSES RECORD   11)   USER RESPONSIBLE"
@ 11,64 SAY "FOR FILE"
@ 13,9 SAY "5)   PROGRAM PROCESSES ELEMENT  12)   PROGRAM PRODUCES"
@ 13,64 SAY "DOCUMENT"
@ 15,9 SAY "6)   SYSTEM CONTAINS PROGRAM    13)   RETURN TO PREVIOU"
@ 15,64 SAY "S MENU"
@ 17,9 SAY "7)   PROGRAM CONTAINS MODULE    14)   RETURN TO MAIN ME"
@ 17,64 SAY "NU"
@ 18,22 SAY " "
ACCEPT '         ENTER YOUR CHOICE (1-14) FROM ABOVE:'TO choice
DO CASE
CASE choice = "1"
store 'U_PROC_S' to choice
store 'USER CONTAINS SYSTEM' TO title
save to mem_var
do 152100
CASE choice = "2"
store 'S_PROC_P' to choice
store 'SYSTEM CONTAINS PROGRAM' TO title
save to mem_var
do 152100
CASE choice = "3"
store 'P_PROC_F' to choice
store 'PROGRAM PROCESSES FILE' TO title
save to mem_var
do 152100
CASE choice = "4"
store 'P_PROC_R' to choice
store 'PROGRAM PROCESSES RECORD' TO title
save to mem_var
do 152100
CASE choice = "5"
store 'P_PROC_E' to choice
store 'PROGRAM PROCESSES ELEMENT' TO title
save to mem_var
do 152100
CASE choice = "6"
store 'S_CONT_P' to choice
store 'SYSTEM CONTAINS PROGRAM' TO title
save to mem_var
do 152100
CASE choice = "7"
store 'P_CONT_M' to choice
store 'PROGRAM CONTAINS MODULE' TO title
save to mem_var
do 152100
CASE choice = "8"
store 'F_CONT_R' to choice
store 'FILE CONTAINS RECORD' TO title
save to mem_var
do 152100
```

```
CASE choice = "9"
store 'R_CONT_E' to choice
store 'RECORD CONTAINS ELEMENT' TO title
save to mem_var
do 152100
CASE choice = "10"
store 'U_RESP_S' to choice
store 'USER RESPONSIBLE FOR SYSTEM' TO title
save to mem_var
do 152100
CASE choice = "11"
store 'U_RESP_F' to choice
store 'USER RESPONSIBLE FOR FILE' TO title
save to mem_var
do 152100
CASE choice = "12"
store 'P_PROD_D' to choice
store 'PROGRAM PRODUCES DOCUMENT' TO title
save to mem_var
do 152100
CASE choice = "13"
RETURN
CASE choice = "14"
RETURN TO MASTER
OTHERWISE
CLEAR
@ 1,21 SAY choice
@ 1,28 SAY "IS NOT A VALID CHOICE"
@ 2,20 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 14 ONLY"
@ 3,20 SAY "PRESS RETURN TO TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
RETURN
```

```
* 152100.PRG
* MODULE NAME: 1.5.2.1.0.0
* ROUTINES THAT CALL THE MODLUE: 1.5.2.0.0.0
* ROUTINES THAT THE MODULE CALLS:1.5.2.0.0.0
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       t: REPRESTENTS NO VALUE AT ALL.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
*                       count: KEEPS TRACK OF ACCOUNT NUMBERS.
*                       option:
* INPUT FILES: MEM_VAR.
* OUTPUT FILES: MEM_VAR.
* THIS MODULE ALLOW THE USER TO CHOOSE WHICH TYPE OF RELATIONSHIP WILL BE
* USED IN THE QUERY.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE ALLOW THE USER TO CHOOSE WHETHER THE OUTPUT WILL BE
* DISPLAYED ON THE SCREEN OR PRINTED.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
STORE .t. TO TRUE
do while TRUE
CLEAR
@ 0,1 SAY "1.5.2.1.0.0"
RESTORE FROM mem_var
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,22 SAY "    RELATIONSHIP SCHEMA OUTPUT"
@ 8,23 SAY "LISTED BELOW ARE THE CHOICES FOR"
@ 9,23 SAY "HOW YOU CAN HAVE THE SCHEMA FOR"
@ 10,24 SAY TITLE
@ 11,23 SAY "DISPLAYED."
@ 13,28 SAY "1)  SCREEN OUTPUT"
@ 15,28 SAY "2)  PRINTER OUPUT"
@ 17,28 SAY "3)  RETURN TO PREVIOUS MENU"
@ 18,1 SAY " "
ACCEPT'         ENTER YOUR CHOICE (1-3) FROM ABOVE 'TO option
ERASE mem_var.mem
SAVE TO mem_var
DO CASE
CASE option = '1'
DO CASE
CASE CHOICE = 'U_PROC_S'
DO 152110
CASE choice = 'S_PROC_P'
```

```
DO 152110
CASE CHOICE = 'P_PROC_F'
DO 152110
CASE choice = 'P_PROC_R'
DO 152110
CASE CHOICE = 'P_PROC_E'
DO 152110
CASE choice = 'S_CONT_P'
DO 152110
CASE CHOICE = 'P_CONT_M'
DO 152110
CASE choice = 'F_CONT_R'
DO 152110
CASE CHOICE = 'R_CONT_E'
DO 152110
CASE choice = 'U_RESP_S'
DO 152110
CASE CHOICE = 'U_RESP_F'
DO 152110
CASE choice = 'P_PROD_D'
DO 152110
ENDCASE
CASE option = '2'
DO CASE
CASE CHOICE = 'U_PROC_S'
DO 152120
CASE choice = 'S_PROC_P'
DO 152120
CASE CHOICE = 'P_PROC_F'
DO 152120
CASE choice = 'P_PROC_R'
DO 152120
CASE CHOICE = 'P_PROC_E'
DO 152120
CASE choice = 'S_CONT_P'
DO 152120
CASE CHOICE = 'P_CONT_M'
DO 152120
CASE choice = 'F_CONT_R'
DO 152120
CASE CHOICE = 'R_CONT_E'
DO 152120
CASE choice = 'U_RESP_S'
DO 152120
CASE CHOICE = 'U_RESP_F'
DO 152120
```

```
CASE choice = 'P_PROD_D'
DO 152120
ENDCASE
CASE option = '3'
RETURN
OTHERWISE
CLEAR
@ 0,27 SAY option
@ 0,34 SAY "IS NOT A VALID CHOICE"
@ 1,26 SAY "PLEASE ENTER VALUES BETWEEN 1 AND 3 ONLY"
@ 2,26 SAY "PRESS RETURN AND TRY AGAIN!"
ACCEPT TO hold
ENDCASE
ENDDO
```

```
* 152110.PRG
* MODULE NAME: 1.5.2.1.1.0
* ROUTINES THAT CALL THE MODLUE: 1.5.2.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.5.2.1.0.0
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* INPUT FILES: MEM_VAR U_CONTS, U_CONT_S, U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PRED_D.
* OUTPUT FILES: MEM_VAR
*               U_CONTS, U_CONT_S, U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PRED_D.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL DISPLAY ON THE RELATIONSHIP SCHEMAS
*
RESTORE FROM mem_var
CLEAR
@ 0,1 SAY "1.5.2.1.1.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,25 SAY "RELATIONSHIP SCHEMA SCREEN OUTPUT"
@ 5,22 SAY "THIS MODULE WILL DISPLAY"
@ 7,23 SAY TITLE
@ 9,22 SAY "IF YOU DO NOT WISH TO DISPLAY"
@ 10,22 SAY "THIS SCHEMA, TYPE '0' TO"
@ 11,22 SAY "RETURN TO THE PREVIOUS MENU."
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
CLEAR
@ 0,1 SAY "1.5.2.1.1.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,28 SAY "RELATIONSHIP SCHEMA FOR"
@ 5,27 SAY title
@ 7,1 SAY " "
DO CASE
CASE choice = 'U_PROC_S'
USE U_PROC_S
DISPLAY STRUCTURE
WAIT TO hold
RETURN
```

```
CASE choice = 'S_PROC_P'
USE S_PROC_P
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'P_PROC_F'
USE P_PROC_F
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'P_PROC_R'
USE P_PROC_R
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'P_PROC_E'
USE P_PROC_E
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'S_CONT_P'
USE S_CONT_P
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'P_CONT_M'
USE P_CONT_M
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'F_CONT_R'
USE F_CONT_R
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'R_CONT_E'
USE R_CONT_E
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'U_RESP_S'
USE U_RESP_S
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'U_RESP_F'
```

```
USE U_RESP_F
DISPLAY STRUCTURE
WAIT TO hold
RETURN
CASE choice = 'P_PROD_D'
USE P_PROD_D
DISPLAY STRUCTURE
WAIT TO hold
RETURN
```

```
* 152120.PRG
* MODULE NAME: 1.5.2.1.2.0
* ROUTINES THAT CALL THE MODLUE: 1.5.2.1.0.0
* ROUTINES THAT THE MODULE CALLS:1.5.2.1.0.0
* LOCAL VARIABLES USED: choice: CONTAINS THE NUMBER OF ACTION SELECTED.
*                       hold: USED TO STOP ACTION FOR USER DECISION.
* INPUT FILES: MEM_VAR U_CONTS, U_CONT_S, U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PROD_D.
* OUTPUT FILES: MEM_VAR
*               U_CONTS, U_CONT_S, U_CONT_P, P_PROC_F, P_PROC_R,
*               P_PROC_R. P_PROC_E. S_CONT_P, P_CONT_M, F_CONT_R, R_CONT_E,
*               U_RESP_S, U_RESP_F, P_PROD_D.
* DESIGNED BY:  ROBERT A. KIRSCH II
* WRITTEN  BY:  ROBERT A. KIRSCH II
* BASIC FUNCTION OF MODULE:
* THIS MODULE WILL OUTPUT THE USER, SYSTEM, PROGRAM AND MODULE
* RELATION FILES TO THE PRINTER.
*
RESTORE FROM mem_var
STORE 0 TO rec_num, stop
CLEAR
@ 0,1 SAY "1.5.1.1.2.0"
@ 1,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 3,27 SAY "RELATIONSHIP PRINTER OUTPUT"
@ 6,23 SAY "THIS MODULE WILL PRINT"
@ 8,24 SAY TITLE
@ 10,23 SAY "PLEASE INSURE THAT YOUR PRINTER"
@ 11,23 SAY "IS TURNED ON AND IN THE ONLINE"
@ 12,23 SAY "MODE"
@ 14,23 SAY "IF YOU DO NOT WISH TO PRINT"
@ 15,23 SAY "THIS RELATION, TYPE '0' TO"
@ 16,23 SAY "RETURN TO THE PREVIOUS MENU"
WAIT TO stop
DO CASE
CASE stop = '0'
RETURN
OTHERWISE
ENDCASE
SET DEVICE TO PRINT
SET CONSOLE OFF
@ 1,1 SAY "1.5.1.1.2.0"
@ 2,22 SAY "INFORMATION RESOURCE DICTIONARY SYSTEM"
@ 4,36 SAY "SCHEMA FOR"
@ 6,23 SAY title
@ 9,1 SAY " "
```

```
DO CASE
CASE choice = 'U_PROC_S'
USE U_PROC_S
DISPLAY STRUCTURE TO PRINT
CASE choice = 'S_PROC_P'
USE S_PROC_P
DISPLAY STRUCTURE TO PRINT
CASE choice = 'P_PROC_F'
USE P_PROC_F
DISPLAY STRUCTURE TO PRINT
CASE choice = 'P_PROC_R'
USE P_PROC_R
DISPLAY STRUCTURE TO PRINT
CASE choice = 'P_PROC_E'
USE P_PROC_E
DISPLAY STRUCTURE TO PRINT
CASE choice = 'S_CONT_P'
USE S_CONT_P
DISPLAY STRUCTURE TO PRINT
CASE choice = 'P_CONT_M'
USE P_CONT_M
DISPLAY STRUCTURE TO PRINT
CASE choice = 'F_CONT_R'
USE F_CONT_R
DISPLAY STRUCTURE TO PRINT
CASE choice = 'R_CONT_E'
USE R_CONT_E
DISPLAY STRUCTURE TO PRINT
CASE choice = 'U_RESP_S'
USE U_RESP_S
DISPLAY STRUCTURE TO PRINT
CASE choice = 'U_RESP_F'
USE U_RESP_F
DISPLAY STRUCTURE TO PRINT
CASE choice = 'P_PROD_D'
USE P_PROD_D
DISPLAY STRUCTURE TO PRINT
ENDCASE
SET DEVICE TO SCREEN
SET CONSOLE ON
RETURN
```

LIST OF REFERENCES

1. Leong-Hong, B., and Marron, B., Technical Profile of Seven Data Element Dictionary/Directory Systems, NBS Special Publication 500-3, Feburary, 1977.

2. Codd, E. F., "Relational Database: A Practical Foundation for Productivity.", In Communication of the ACM, Vol 25, No2, February 1982.

3. Kroenke, David, DATABASE PROCESSING: Fundamentals, Design, Implementation, Second Edition, Science Research Associates, Inc., p. 401, 1983.

4. Ibid, p. 402.

5. Konig, P.A. and Goldfine, A.H., A Technical Overview of the Information Resource Dictionary System, National Bureau of Standards, Gaithersburg, MD, March, 1985.

6. Lefkovits, H. C., Sibley, E. H., and Lefkovits, S. L., Information Resource/Data Dictionary Systems, QED Information Sciences, 1977, pp. 1-46

7. Seesing, Paul R., A Data Dictionary Model For Relational Databases, U.S. Dept of Energy, October, 1983.

8. Curtice, Robert M., Data Dictionaries: An Assessment of Current Practice and Problems, IEEE, 1981.

9. Ibid, pp. 564-565

10. Curtice, Robert M., Data Dictionaries: An Assessment of Current Practice and Problems, IEEE, 1981.

11. Kroenke, David, DATABASE PROCESSING: fundamentals, Design, Implementation.

12. Landin, S. L., and Owens, R. L., An Analysis fo Data Dictionaries and Their Role in Information Resource Management, Thesis, Naval Postgraduate School, Monterey, California, September 1984.

13. Noel, A., Relational Data Dictionaries and Prototyping, Masters Thesis, Naval Postgraduate School, Monterey, California, June 1985.

14. Vanecek, M., T., Solomon I,. and Mannino M., V., "The Data Dictionary: an Evaluation from the EDP Audit Prospective", MIS Quarterly Volume 7, Number 1, March, 1983.

15. Vanecek, M., T., Solomon I,. and Mannino M., V., "The Data Dictionary: an Evaluation from the EDP Audit Prospective".

16. Uhrowczik, P. P., "Data Dictionary/Directiories", Computing Surveysm Vol. 16, No. 1, pp. 332-350, March 1984.

17. Allen, F. W., Loomis, M. E. S., and Mannino M. V., "The Integrated Dictionary/Directory system", Computing Surveys, Vol. 14, No. 2, June 1982.

18. Lefkovits, H. C., Sibley, E. H., and Lefkovits, S. L., Information Resource/Data Dictionary Systems, pp. 1-46, QED Information Sciences, 1977.

19. Durell, W., "Disorder to Disciplime Via the Data Dictionary", Journal of Systems Management, May, 1983.

20. Ibid, pp. 14-15.

21. Ibid, p. 17.

22. Ibid, p. 18.

23. Allen, F. W., Loomis, M. E. S., and Mannino M. v., The Intgrated Dictionary/Directory System, Computing Surveys, Vol. 14, No. 2, June 1982.

24. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 1 -- Core Standard, New York, 1985.

25. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 2 -- Core Standard, New York, 1985.

26. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 3 -- Core Standard, New York, 1985.

27. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 4 -- Core Standard, New York, 1985.

28. National Bureau of Standards, NBSIR 80-2115, Prospectus for Data Dictionary System Standard, Application Systems Division, Gaithersburg, MD, September, 1980.

30. National Bureau of Standards, Gaithersburg, MD, NBSIR 82-2619, Functional Specifications for a Federal Information Processing Standard Data Dictionary System, P. A. Konig, A. H. Goldfine, and J. J. Newton, September, 1980.

31. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 1 -- Core Standard, New York, 1985.

32. Ibid, pp. 578-600.

33. Ibid, pp. 601-685.

34. Ibid, pp. 686-743.

35. Codd, E. F., "Relational Database: A Practical Foundation for Productivity.", In Communication of the ACM, Vol 25, No2, February 1982.

36. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 2 -- Core Standard, New York, 1985.

37. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 3 -- Core Standard, New York, 1985.

38. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 4 -- Core Standard, New York, 1985.

39. Noel, A., Relational Data Dictionaries and Prototyping, Masters Thesis, Naval Postgraduate School, Monterey, California, June 1985.

40. Carey, T. T. and Mason, R.E.A., "Prototyping Interactive Information Systems", Communications of the ACM, V26, May 1983.

41. Pressman, R. S., Software Engineering: A Practitioner's Approach, McGraw-Hill, New York, NY, 1982.

42. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 3 -- Core Standard, New York, 1985.

43. Blum, B. I., "Rapid Prototyping of Information Management Systems", ACM SIGSOFT Software Engineering Notes, V7, December 1982.

44. Pressman, R. S., Software Engineering: A Practitioner's Approach, McGraw-Hill, New York, NY, 1982.

45. Sprague R. H. and Carlson E. D., Building Effective Decision Support Systems, Printice-Hall, Inc., Englewood Cliffs, New Jersey, 1982.

46. Wasserman, A. I. and Shewmake, D. T., "Rapid Prototyping of Interactive infromation Systems", ACM SIGSOFT Sofrware Engineering Notes, V7, December 1982.

47. American National Standards Institute, ANSI X3H4, (Draft Proposed) American National Standard Information Resource Dictionary System: Part 1 -- Core Standard, New York, 1985.

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